N.° 3

A

# DISSERTATION

ON THE

# FOOD

AND

# DISCHARGES

OF

# HUMAN BODIES.

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# PREFACE.

IN the following Diſſertation I have given an Account from Experiments, of the Food and Diſcharges of human Bodies. By the Statical Tables it appears, that in *England*, *Ireland*, and *South Carolina*, Perſpiration is conſiderably greater in the Day than in the Night; whereas, by the Aphoriſms of *Sanctorius*, the contrary

obtains in *Italy*; for in ſeven Hours of quiet Sleep a Perſon there perſpires twice as much, as he does when awake in an equal Time. A firm Belief of this Doctrine of *Sanctorius*, and that it obtains in other Countries as *Sanctorius* affirms it does in *Italy*, has hurt many. For it is natural for Perſons thus perſuaded, when they awake in the Morning, and find any Moiſture on their Skin, to be afraid of riſing leſt they ſhould check Perſpiration, and to continue in Bed till the Moiſture goes off of itſelf; by which erroneous Conduct they relax and weaken their Conſtitutions, and frequently become Valetudinarians, from being Perſons of naturally ſtrong and healthful Bodies.

*Sanctorius*

*Sanctorius* ſeems to have had a different Opinion of the Proportion of Perſpiration to Urine at different Seaſons of the Year, from what appears by our Tables. He ſeems not to have much regarded Urine in compariſon of Perſpiration; and yet they are not far from being equal in the whole Year, taking one Day, one Month, and one Seaſon with another, as appears by Tables 2, 7, 9. And, what is very remarkable, Urine in the whole Year exceeds Perſpiration, not only in *England* and *Ireland*, but even in *South Carolina*, a Country much hotter than *Italy*.

But tho' *Sanctorius* may have advanced ſome Things which are not

not true, and ſome which are true only under certain Circumſtances, yet he is highly to be honoured for what he has done; and had he known the Circulation of the Blood, and been acquainted with true Philoſophy, we may eaſily grant, that he would not have left any thing material on this Subject to be done by others.

A DIS-

# A DISSERTATION ON THE FOOD and DISCHARGES OF HUMAN BODIES.

AS the Discharges of human Bodies depend upon, and are regulated by, the Motion of the Blood; so it may be proper to premise a short Account of that Motion, by which the Nature of the Discharges by Perspiration, Urine and Stool, will be more clearly understood than they could be without it.

The Account here given of the Blood's Motion, is drawn from what I have delivered concerning it in the *Animal Oeconomy*, and from other Experiments and Obfervations. I fhall, by way of Illuftration, fubjoin fome Tables and Obfervations drawn from Experiments made on other Animals.

### *Of the Motion of the Blood.*

IF a healthful Body be fituated in a given manner with refpect to the Horizon, the Velocity with which the Blood flows out of the left Ventricle of the Heart into the Aorta, is in the fubduplicate Ratio of the Diameter of the Aorta; and if the Body be perfectly well proportioned, and its Heart be free from the Influences of all difturbing Caufes, the Velocity with which the Blood flows out of the Heart into the Aorta, is in the fubquadruplicate Ratio of the Length of the Body; by *Cor.* 4. *Prop.* 12. *Anim. Oecon.* And the Morning Number of Pulfes in a Minute of a healthful

Body,

Body, when it is ſitting, and its Heart is free from the Influences of all diſturbing Cauſes, is as the Velocity of the Blood in the Aorta apply'd to the Length of the Body, by *Cor.* 1. *Prop.* 14; and if the Body be perfectly well proportioned, its Morning Number of Pulſes in a Minute is in the ſubquadruplicate Ratio of the Length of the Body, apply'd to the Length of the Body. To expreſs theſe Proportions in Symbols, let D denote the Diameter of the Aorta in Inches and decimal Parts, when the Aorta is moderately diſtended by the Syſtole of the Heart; L the Length of the Body in Inches; P the Morning Number of Pulſes in a Minute, when the Body is ſitting, and its Heart is free from the Influences of all diſturbing Cauſes; and V the Velocity with which the Blood flows out of the left Ventricle of the Heart into the Aorta, expreſſed in the Inches it deſcribes in a ſecond Minute of Time; and then V will be as $D^{\frac{1}{2}}$, and P as $\frac{D^{\frac{1}{2}}}{L}$ in all healthful Bodies in the Morning, when the Bodies are ſitting,

and their Hearts are free from the Influences of all disturbing Causes; and V will be as $L^{\frac{1}{4}}$, and P as $\frac{L^{\frac{1}{4}}}{L}$ in all healthful and perfectly well proportioned Bodies under the same Circumstances. Hence, if we can find V and P in a healthful and well proportioned Body of any one Length, we may find them by their Measures $L^{\frac{1}{4}}$ and $\frac{L^{\frac{1}{4}}}{L}$, in healthful and well proportioned Bodies of all other Lengths in the Morning, when the Bodies are sitting, and their Hearts are free from the Influences of all disturbing Causes.

The Velocity with which the Blood flows out of the left Ventricle of the Heart into the Aorta, may be found by knowing the cubick Inches of Blood which flow into the Aorta in one Systole, the Orifice of the Aorta in square Inches and decimal Parts of an Inch, and the Time of one Systole in Seconds and decimal Parts of a Second; for, putting K for the cubick Inches of Blood which

flow

flow out of the Heart into the Aorta in one Syſtole, O for the Orifice of the Aorta in ſquare Inches and decimal Parts, and T for the Time of one Syſtole in Seconds and decimal Parts of a Second, $\frac{K}{OT}$ will be equal to V. For $\frac{K}{O}$ is the Length deſcribed by the Blood with the Velocity V in the Time T, and $\frac{K}{OT}$ is the Length deſcribed with the ſame Velocity in 1″. For the Velocity being given, the Times are as the Spaces deſcribed in thoſe Times, that is, $T . 1'' :: \frac{K}{O} \cdot \frac{K}{OT} = V$. The Time of one Syſtole of the Heart in Seconds and Parts of a Second, may be found from the Number of Pulſes in a Minute, that is, T may be found from P. For allowing, what is generally ſuppoſed, the Time of one Syſtole, to be but half the Time of a Diaſtole, the whole Time of all the Syſtoles, or all the Pulſes, in a Minute, will be only 20 Seconds. But if the Time of P Pulſes be 20 Seconds, the Time of one

Pulſe

Pulse will be $\frac{20}{P}$, which Time is equal to T. And therefore, if $\frac{20}{P}$ be substituted instead of T in the foregoing Measure of the Velocity $\frac{K}{O\ T}$, we shall have $\frac{K\ P}{20\ O} = V$.

If 1500 Grains, or 5.6177 cubick Inches of Blood, flow out of the left Ventricle of the Heart into the Aorta in one Systole, in a strong well proportion'd Man 72 Inches in Length, when his Heart is free from the Influences of all disturbing Causes; and if the Periphery of his Aorta when distended by the Force of the Heart pressing out this Quantity of Blood, be 3.5 Inches; all which may be allowed as not exceeding the Truth; then putting D for the Diameter of the Aorta, we shall have $D = 1.114085$, $D^2 = 1.241185$, $D^{\frac{1}{2}} = 1.0555$, and $O = 0.974824$. From some Experiments, the Morning Pulse of such a Man, when he is sitting and his Heart is free from the Influences of all disturbing Causes, beats about 54 times in a Minute.

a Minute. This Number, though considerably leſs than the Number aſſigned to ſtrong well proportioned Bodies of that Length in the Table p. 136 of the *Animal Oeconomy*, yet I believe is much nearer the Truth, and may be allowed in Bodies which live regularly, and eat and drink but little at Night; for eating and drinking plentifully at Night commonly makes the Pulſe quicker the next Morning. The Number 65 in that Table, was a Mean taken from the Morning Pulſes of 120 Soldiers, and on that account might be greater than the Number correſponding to ſtrong well proportioned Men of that Length, who live in a very regular and temperate manner. In ſuch Bodies therefore K is 5.6177, P is 54, $20 \times Q$ is 19.496480, and $\frac{K\ P}{20\ Q}$ is 15.48 Inches, equal to V. So that the Blood flows out of the Heart into the Aorta of ſtrong well proportioned Men 72 Inches in Length, when their Hearts are not influenced by diſturbing Cauſes, with a Velocity that carries it at the rate of 15.48 Inches in 1″.

This

This Velocity being found, the Velocity with which the Blood flows into the Aorta of a perfectly well proportioned Body of any other Length in the Morning when the Body is sitting, and its Heart is free from the Influences of all disturbing Causes, may be found by this Analogy. As 2.913 the biquadrate Root of 72, is to 15.48, the Velocity of the Blood flowing into the Aorta of a healthful well proportioned Body 72 Inches in Length, in the Morning when the Body is sitting, and its Heart is free from the Influences of all disturbing Causes; so is the biquadrate Root of the Length of any other healthful well proportioned Body, in the same Situation and same undisturbed State of the Heart, to the Velocity with which the Blood flows into the Aorta of that Body; that is, $2.913 : 15.48 :: L^{\frac{1}{4}} . V$; whence $5.314\, L^{\frac{1}{4}} = V$. By this Measure of V, the Numbers in the Column V of Table 1. were computed. The Numbers in the Column P of the same Table, were computed by a Measure formed from this

Analogy:

Analogy: as 0.04472 the biquadrate Root of 63 divided by 63, is to 60 the Morning Number of Pulſes in a Minute of a healthful well proportioned Body 63 Inches in Length, when the Body is ſitting and its Heart is free from the Influences of all diſturbing Cauſes; ſo is the biquadrate Root of the Length of any other healthful well proportioned Body divided by that Length, to the Morning Number of Pulſes in a Minute, when the Body is ſitting, and its Heart is free from the Influences of all diſturbing Cauſes; that is, $0.04472 : 60 :: \frac{L^{\frac{1}{4}}}{L} : P$. Whence, $1341.7 \times \frac{L^{\frac{1}{4}}}{L} = P$. And the Numbers in the Column F were computed by a Meaſure formed from this Analogy. $63 \times 63^{\frac{1}{4}} = 177.4899 : 56 :: L \times L^{\frac{1}{4}} . F$: Whence $0.3155 \times L \times L^{\frac{1}{4}} = F$. Theſe Meaſures of V, P and F, may be allowed in healthful well proportioned Bodies, whoſe Hearts are not influenced by diſturbing Cauſes.

TABLE I.

| L | $L^{\frac{1}{4}}$ | V | $\frac{L^{\frac{1}{4}}}{L}$ | P | $L \times L^{\frac{1}{4}}$ | F |
|---|---|---|---|---|---|---|
| 72 | 2.9130 | 15.48 | 0.04046 | 54 | 209.7360 | 66.17 |
| 70 | 2.8925 | 15.37 | 0.04132 | 55 | 202.4750 | 63.88 |
| 68 | 2.8716 | 15.26 | 0.04223 | 57 | 195.2688 | 61.60 |
| 66 | 2.8503 | 15.15 | 0.04319 | 58 | 188.1198 | 59.35 |
| 64 | 2.8284 | 15.03 | 0.04419 | 59 | 181.0176 | 57.11 |
| 63 | 2.8173 | 14.97 | 0.04472 | 60 | 177.4899 | 56.00 |
| 62 | 2.8060 | 14.91 | 0.04526 | 61 | 173.9782 | 54.89 |
| 60 | 2.7830 | 14.79 | 0.04638 | 62 | 166.9860 | 52.68 |
| 58 | 2.7596 | 14.66 | 0.04758 | 64 | 160.0568 | 50.50 |
| 56 | 2.7355 | 14.54 | 0.04885 | 66 | 153.1880 | 48.33 |
| 54 | 2.7108 | 14.41 | 0.05020 | 67 | 146.3832 | 46.18 |
| 52 | 2.6854 | 14.27 | 0.05164 | 69 | 139.6408 | 44.06 |
| 50 | 2 6592 | 14.13 | 0.05318 | 71 | 132.9550 | 41.95 |
| 48 | 2.6322 | 13.99 | 0.05483 | 74 | 126.3456 | 39.86 |
| 46 | 2.6043 | 13.84 | 0.05661 | 76 | 119.7978 | 37.80 |
| 44 | 2.5755 | 13.69 | 0.05853 | 79 | 113.3220 | 35.75 |
| 42 | 2.5456 | 13.53 | 0.06061 | 81 | 106.9194 | 33.73 |
| 40 | 2.5149 | 13.36 | 0.06287 | 84 | 100.5960 | 31.74 |
| 38 | 2.4828 | 13.19 | 0.06534 | 88 | 94.3464 | 29.77 |
| 36 | 2.4495 | 13.02 | 0.06804 | 91 | 88.1820 | 27.82 |
| 34 | 2.4147 | 12.83 | 0.07102 | 95 | 82.0998 | 25.90 |
| 32 | 2.3784 | 12.64 | 0.07432 | 100 | 76.1088 | 24.01 |
| 30 | 2.3403 | 12.44 | 0.07801 | 105 | 70.2090 | 22.15 |
| 28 | 2.3003 | 12.22 | 0.08215 | 110 | 64.4084 | 20.32 |
| 26 | 2.2581 | 12.00 | 0.08685 | 117 | 58.7106 | 18.52 |
| 24 | 2.2134 | 11.76 | 0.09222 | 124 | 53.1192 | 16.76 |
| 22 | 2.1658 | 11.51 | 0.09844 | 132 | 47.6454 | 15.03 |
| 20 | 2.1147 | 11.24 | 0.10573 | 142 | 42.2940 | 13.34 |
| 18 | 2.0598 | 10.95 | 0.11443 | 154 | 37.0746 | 11.70 |
| 16 | 2.0000 | 10.63 | 0.12500 | 168 | 32.0000 | 10.10 |
| 14 | 1.9343 | 10.28 | 0.13816 | 185 | 27.0802 | 8.54 |
| 12 | 1.8612 | 9.89 | 0.15510 | 208 | 22.3344 | 7.05 |

The

The Velocity, with which the Blood flows out of the left Ventricle of the Heart into the Aorta of a healthful Body, when it is ſitting, and its Heart is free from the Influences of all diſturbing Cauſes, being univerſally as the ſquare Root of the Diameter of the Aorta; that is, V being univerſally as $D^{\frac{1}{2}}$; and V and $D^{\frac{1}{2}}$ in a well proportioned Body 72 Inches in Length, being 15.48 and 1.0555; the Velocity, with which the Blood flows into the Aorta of any other healthful Body under the ſame Circumſtances, may be found by this Analogy. $15.48 : 1.0555 :: V : D^{\frac{1}{2}}$. Whence $14.667\,D^{\frac{1}{2}} = V$.

The diſturbing Cauſes of the Motion of the Heart are Changes in the ſenſible Qualities of the Air, Heat and Cold, Dryneſs and Moiſture, Errors in Food, in Exerciſe of Body, in the Times of ſleeping and waking, and the Paſſions of the Mind; that is, a wrong Uſe of the *Non-naturals* is the common diſturbing Cauſe of the Motion of the Heart.

TABLE 2.

| | | | | | | |
|---|---|---|---|---|---|---|
| W | . | w | :: | 24 | . | 1 |
| H | . | h | :: | 16 | . | 1 |
| L | . | l | :: | 4 | . | 1 |
| D | . | d | :: | 2 | . | 1 |
| P | . | p | :: | 7 | . | 20 |
| V | . | v | :: | 7 | . | 5 |
| Q | . | q | :: | 28 | . | 5 |

In *Table* 2 are exhibited, the Proportions of the Weights of the Bodies, of a healthful ſtrong well proportioned Man, and a healthful ſtrong well proportioned Child newly born; the Proportions of the Weights of their Hearts, of the Lengths of their Bodies, of the Diameters of their Aortas, of their Pulſes in a Minute when their Hearts are free from the Influences of diſturbing Cauſes, of the Velocities of the Blood in their Aortas, and of the Quantities of Blood which in a given Time flow through their Hearts or Lungs, when their Hearts are not affected by diſturbing Cauſes. And from theſe Proportions compared with one another

another will ariſe ſome uſeful Obſervations.

*Obſ.* 1. The Weight of the Heart with reſpect to the Weight of the Body, is greater in Children than in grown Bodies. It was greater in the Child than in the Man, in the Proportion of 3 to 2. For, $\frac{h}{w} . \frac{H}{W} :: 1 . \frac{16}{24} :: 3 . 2.$

Hence the Weight of the Heart with reſpect to the Weight of the Body, leſſens continually from the Birth till Bodies come to their full Growth.

*Obſ.* 2. The Quantity of Blood which flows through the Heart or Lungs in a given Time, in Proportion to the Weight of the Heart, or Quantity of Blood contained in the Body, which Quantity of Blood is proportional to the Weight of the Heart, is greater in Children than in grown Bodies. It was greater in the Child than in the Man, in the Proportion of 20 to 7. For $\frac{q}{h} . \frac{Q}{H} :: \frac{5}{1} . \frac{28}{16} :: 20 . 7,$

which

which is the Proportion of their Pulses in a Minute.

Hence, the Quantity of Blood that flows through the Heart or Lungs in a given Time, in Proportion to the whole Quantity of Blood contained in the Body, lessens continually from the Birth till Bodies arrive at their full Growth.

*Obs.* 3. The Velocity of the Blood with respect to its Quantity, which Quantity is as the Weight of the Heart, is much greater in Children than in grown Bodies; it was greater in the Child than in the Man, in the Proportion of 80 to 7. For $\frac{v}{h} . \frac{V}{H} :: \frac{5}{1} . \frac{7}{16} :: 80 . 7.$

Hence, though the Blood of Children moves slower than the Blood of grown Bodies, yet for its Quantity it moves much quicker, and much oftener passes through the Lungs. On which account the Blood of Children, notwithstanding the Slowness of its Motion, may by passing

ſing oftener through the Lungs, and thereby receiving more of the Acid of the Air in Proportion to its Quantity, be more fluid, and of a brighter Colour, than the Blood of grown Perſons.

*Obſ.* 4. The Quantity of Blood that flows through the Heart or Lungs in a given Time, in Proportion to the Weight of the Body, is greater in Children than in grown Bodies. It was greater in the Child than in the Man in the Proportion of 30 to 7. For $\frac{q}{w} . \frac{Q}{W} :: \frac{5}{1} . \frac{28}{24} :: 30 . 7$.

Hence, though the Velocity of the Blood is leſs in Children than in grown Bodies, yet its Motion with reſpect to the Weight of the Body is greater.

*Obſ.* 5. The Velocity of the Blood with reſpect to the Length of the Body, is greater in Children than in grown Bodies. It was greater in the Child than in the Man, in the Proportion of 20 to 7, which

which is the Proportion of their Pulses in a Minute. For $\frac{v}{l} \cdot \frac{V}{L} :: \frac{5}{1} \cdot \frac{7}{4} :: 20 \cdot 7$.

Hence, the Velocity of the Blood, and Number of Pulses in a Minute, with respect to the Length of the Body, lessen continually in growing Bodies till they arrive at their full Growth.

Several other Observations may be made from comparing the Proportions of this Table with one another.

To form some Idea of the slow Motion of the Blood in the capillary Blood-vessels, we must know the Bigness of the red Corpuscles of healthful arterial Blood, and the Order of Colours in the Table p. 88. of the *Dissertation on the Æther of Sir Isaac Newton*, to which Order the red Colour of those Corpuscles belongs. To know the Bigness of the red Corpuscles of healthful arterial Blood, we must allow for their Density, which by Doctor *Jurin*'s Experiments, is 1.126, the Density of Water being 1.

For

For were thoſe Corpuſcles tranſparent, their Denſity is ſuch, that the Sine of Incidence upon them would be to the Sine of Refraction, as $\sqrt{2.126} = 1.4581$, is to 1, by *Cor. Prop.* 9. of the *Diſſertation.* And therefore the Thickneſs of the Corpuſcles, that they may exhibit the ſame red Colour with thoſe of Bubbles of Water of the firſt Order in the Table, muſt be leſs than the Thickneſs of the Skins of thoſe Bubbles in the Proportion of 1 to 1.4581. And conſequently D, which I put for the Thickneſs of the Corpuſcles, will be equal to $\frac{1}{148148} \times \frac{1}{1.4581} =$ 0.00000046293 Part of an Inch. The Diameter of the ſmalleſt Blood-veſſel muſt be greater than the Thickneſs of a Corpuſcle, to let a Corpuſcle paſs through it; I ſhall ſuppoſe it to be twice as great, and then the Diameter of the ſmalleſt Blood-veſſel will be the 0.00000092586 Part of an Inch, and the ſquare Root of this Diameter will be the 0.0009636 Part of an Inch, which being multiply'd into 14.667, gives the 0.014 Part of an Inch

for the Space defcribed by the Blood in a capillary Blood-veffel in a Second of Time. With this Velocity the Blood moves at the Rate of 50.4 Inches in an Hour. The Velocity of the Blood in the Aorta of a ftrong well proportioned Man 72 Inches in length, is above 1100 times greater than the Velocity of the Blood in a capillary Blood-veffel; and it is above 780 times greater in the Aorta of a ftrong well proportioned Child 18 Inches in length, than it is in a capillary Blood-veffel. This flow Motion of the Blood in the capillary Veffels is what qualifies it for Secretion.

That the Colour of healthful arterial Blood is the Red of the firft Order, and that the Colour of healthful venal Blood is compofed of the Violet and Indigo of the fecond Order, appears to me very probable from the following Confiderations. The Colour of venal Blood in an inflammatory Fever, when drawn and expofed to the Air, firft changes into a very faint Blue, and then into a White,

or

or Yellowiſh White like the Colour of Buff. Theſe Changes ſhew, the Colour of this venal Blood to be the Beginning of Black of the firſt Order, and that its tinging Corpuſcles are enlarged by the Acid of the Air. This Effect of the Acid of the Air on this venal Blood, is directly contrary to the Effect it produces in healthful venal Blood; for it changes its dark Colour into a good Red, without making it paſs through the intermediate Colours of Blue, Green, Yellow and Orange; and therefore the Red into which it changes it, muſt be the Red of a ſuperior Order; which ſhews that its tinging Corpuſcles are leſſened by the Acid of the Air. The Red into which the Colour of healthful venal Blood changes when expoſed to the Air, muſt be the red of the firſt Order; for if it was the Red of the ſecond Order, as I ſuppoſed in the *Animal Oeconomy*, then the Change of the Colour of venal Blood, compoſed of the Purple and Indigo of the third Order, into the Beginning of Black of the firſt Order the Colour of

inflammatory venal Blood, would be a Change too great to be admitted. But if the Colour of healthful venal Blood be composed of the Violet and Indigo of the second Order, it may be changed by the Heat and Motion of the Blood in an inflammatory Fever, into the Beginning of Black in the first Order without any Inconvenience, and therefore may be allowed.

Hence, the Acid of the Air has a different Effect on the venal Blood in inflammatory Fevers, from what it has on the venal Blood in Health; it enlarges the tinging Corpuscles of the first, and lessens the tinging Corpuscles of the second. Black being the Colour which Bodies put on, when the Corpuscles on which their Colours depend are divided into smaller Particles by Putrefaction; and the Colour of venal Blood in inflammatory Fevers being much nearer to Black, than the Colour of venal Blood in Health; we may hence conclude, that venal Blood in inflammatory Fevers, is nearer

nearer to a State of Putrefaction than venal Blood in Health; and that the Acid of the Air has the ſame Effect upon venal Blood in inflammatory Fevers, as it has upon the Parts of Bodies diſſolved by Putrefaction. All this will be readily conceived from Sir *Iſaac Newton*'s Account of the Compoſition of Particles of Salt, which I ſhall give in his own Words.

"As Gravity makes the Sea flow
" round the denſer and weightier Parts
" of the Globe of the Earth, ſo the At-
" traction may make the watry Acid
" flow round the denſer and compacter
" Particles of Earth for compoſing the
" Particles of Salt. For otherwiſe the
" Acid would not do the Office of a
" Medium between the Earth and com-
" mon Water, for making Salts diſſolvable
" in Water; nor would Salt of Tartar
" readily draw off the Acid from diſ-
" ſolved Metals, nor Metals the Acid
" from Mercury. Now as in the great
" Globe of the Earth and Sea, the
" denſeſt Bodies by their Gravity ſink

" down

"down in Water, and always endeavour "to go towards the Center of the Globe; "ſo in Particles of Salt, the denſeſt Mat- "ter may always endeavour to approach "the Center of the Particle: So that a "Particle of Salt may be compared to a "Chaos; being denſe, hard, dry, and "earthy in the Center; and rare, ſoft, "moiſt, and watry in the Circumference. "And hence it ſeems to be that Salts are "of a laſting Nature, being ſcarce de- "ſtroyed, unleſs by drawing away their "watry Parts by Violence, or by letting "them ſoak into the Pores of the central "Earth by a gentle Heat in Putrefaction, "until the Earth be diſſolved by the "Water, and ſeparated into ſmaller Par- "ticles, which by reaſon of their Small- "neſs make the rotten Compound appear "of a black Colour. Hence alſo it may "be that the Parts of Animals and Ve- "getables preſerve their ſeveral Forms, "and aſſimilate their Nouriſhment; the "ſoft and moiſt Nouriſhment eaſily "changing its Texture by a gentle Heat "and Motion, till it becomes like the "denſe,

" dense, hard, dry, and durable Earth
" in the Center of each Particle. But
" when the Nourishment grows unfit to be
" assimilated, or the central Earth grows
" too feeble to assimilate it, the Motion
" ends in Confusion, Putrefaction and
" Death."

I now proceed to give an Account of the Discharges and Food of human Bodies.

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## *Of the Food and Discharges of Human Bodies.*

### Proposition I.

*THE Sum of the Discharges by Perspiration, Urine, and Stool in a natural Day or any other Time, is equal to the Quantity of Food taken in that Time, lessened by the Difference of the Weights of the Body at the beginning and end of the Time, if the Body be heavier at the end of*

*of the Time than at the beginning; and increaſed by that Difference, if the Body be lighter. If* p, u, *and* s *denote the Quantities of Perſpiration, Urine and Stool diſcharged in a natural Day or any other Time,* F *the Quantity of Food taken in that Time, and* d *the Difference of the Weights of the Body at the beginning and end of the Time; then* $p+u+s=F+d$, *when the Body is lighter, and* $p+u+s=F-d$, *when the Body is heavier, at the end of the Time than at the beginning.*

For if a Body be of the ſame Weight at the beginning and end of a natural Day or any other Time, the Sum of the Diſcharges made by Perſpiration, Urine and Stool, will be equal to the Quantity of Food taken, in that Time. But if the Weight of the Body be greater or leſſer at the beginning of the Time than at the end of it, the Sum of the Diſcharges will fall ſhort of or exceed the Food by the Difference of thoſe Weights. And therefore, that Difference muſt be added to the Food when the Diſcharges exceed

exceed the Food, and ſubducted from the Food when the Food exceeds the Diſcharges; that is, d muſt be added to F in the firſt Caſe, and ſubducted from F in the ſecond, to make $p + u + s = F + d$ when the Body is lighter, and $p + u + s = F - d$ when the Body is heavier at the end of the Time than at the beginning. Therefore the Propoſition is true.

*Cor.* 1. The Quantity of Perſpiration in a natural Day or any other Time, is equal to the Sum of the Food and Difference of the Weights of the Body at the beginning and end of the Time, leſſened by the Quantities of Urine and Stool in that Time, when the Body is lighter at the end of the Time than at the beginning; and equal to the Food leſſened by the Difference of the Weights of the Body, and by the Quantities of Urine and Stool in that Time, when the Body is heavier at the end of the Time than at the beginning: that is, $p = F + d - u - s$ when the Body is lighter, and $p = F - d - u - s$ when the Body is heavier.

Hence, by knowing F, d, u and s, all which may be had by weighing, the Quantity perspired in any Time, whatever that Time be, may be found by this Corollary.

*Cor.* 2. If a Body be of the same Weight at the End of a natural Day or any other Time, as at the Beginning; the Sum of the Discharges, and Quantity of Food, in that Time, will be equal; and Perspiration will be equal to the Food, lessened by the Quantities of Urine and Stool. If d be o, then $p + u + s = F$; and $p = F - u - s$.

*Cor.* 3. If no Food be taken between the two Times of weighing the Body, or, in other Words, if the Person fasts during the intermediate Time; the Sum of the Discharges by Perspiration, Urine, and Stool in that Time, will be equal to the Difference of the Weights of the Body at the Beginning and End of the Time; and Perspiration will be equal to that Difference

ference leſſened by the Quantities of Urine and Stool. For F being o, and d being affirmative, becauſe the Body is neceſſarily lighter at the End of the Time than at the Beginning; $p + u + s = d$, and $p = d - u - s$.

*Cor.* 4. If the Perſpiration and Urine diſcharged in a natural Day or any other Time be equal, and the Body be of the ſame Weight at the end of the Time as at the beginning; double the Quantity of Perſpiration added to the Stool will be equal to the Food; and the Quantity of Perſpiration will be equal to half the Difference of the Food and Stool. If $p = u$, and d be o; then $2p + s = F$, and $p = \frac{F - s}{2}$.

*Cor.* 5. If a Body, by taking a given Quantity of Food in a natural Day, be of the ſame Weight at the end of the Day as at the beginning; the Sum of Perſpiration, Urine, and Stool diſcharged in that Time, will be given. If d be o, and

F be given, or as 1; p + u + s will be given, or as 1. When this Corollary obtains, if one of the three Discharges be increased or lessened, one or the Sum of the other two will be equally lessened or increased; otherwise the Sum of the three could not be given.

## Proposition II.

*THE Sum of the Discharges by Perspiration, Urine and Stool, in a natural Day or any other Time, is nearly proportional to the mean Quantity of Blood, which in that Time flows out of the Heart into the Aorta in one Systole, and the Number of Systoles or Pulses in the same Time, taken together. If* q *denote the mean Quantity of Blood, which in a natural Day or any other Time, flows out of the Heart into the Aorta in one Systole, and* N *the Number of Pulses in that Time, then will* p + u + s *be nearly proportional to* q N.

For the secerning Ducts, which draw off the Humours of Perspiration and Urine

Urine from the Blood, are Continuations of the Blood-veſſels, and differ from them only in this, that they are too ſmall to let the red Parts of the Blood, which are its largeſt Parts, paſs through them; and therefore, the Sum of theſe two Humours flowing through theſe ſmall Ducts in a natural Day or any other Time, will be proportional to the Quantity of Blood that flows out of the Heart into the Aorta in that Time. But the Quantity of Blood which flows out of the Heart into the Aorta in a natural Day or any other Time, is equal to the mean Quantity thrown out of the left Ventricle in one Syſtole, and Number of Syſtoles or Pulſes in that Time, taken together. And therefore, the Sum of Perſpiration and Urine in a natural Day or any other Time, will be proportional to the mean Quantity of Blood thrown into the Aorta in one Syſtole, and Number of Syſtoles or Pulſes in that Time, taken together; that is, $p + u$ will be proportional to $q\,N$. Stool is a very inconſiderable Diſcharge when compared with Perſpiration and Urine; and on that account

account will but little increase their Sum when added to it. And consequently, $p + u + s$ will be nearly proportional to $q N$.

*Cor.* If the same Quantity of Blood, flows out of the Heart into the Aorta in a natural Day, or any other Time; the Sum of the Discharges by Perspiration, Urine and Stool in that Time, will be nearly the same. If $q N$ be given, $p + u + s$ will be nearly given.

$q N$ will be given, when both $q$ and $N$ are given, or when $q$ is as $\frac{1}{N}$. And when $q N$ is given, $p + u + s$ will be nearly given, or nearly as 1. And consequently, when any one of the three Discharges is increased or lessened, one, or the Sum of the other two, will be lessened or increased nearly equally; otherwise their Sum could not be nearly given, or nearly as 1.

PRO-

## Proposition III.

THE *Quantity of Food taken in a natural Day or any other Time, increased by the Difference of the Weights of the Body at the beginning and end of the Time, when the Body is lighter at the end of the Time than at the beginning; and lessened by that Difference, when the Body is heavier, is nearly proportional to the Quantity of Blood which flows out of the left Ventricle of the Heart into the Aorta in that Time; that is,* $F + d$ *is nearly proportional to* $q N$, *when the Body is lighter at the end of the Time than at the beginning; and* $F - d$ *is nearly proportional to* $q N$, *when the Body is heavier.*

For $p + u + s = F + d$, when the Body is lighter, and $p + u + s = F - d$, when the Body is heavier, at the end of the Time at than the beginning; by *Prop.* 1. And $p + u + s$, is nearly proportional to $q N$; by *Prop.* 2. And therefore, $F + d$ is nearly proportional to $q N$ when the Body

Body is lighter, and F — d is nearly proportional to q N when the Body is heavier, at the end of the Time than at the beginning.

*Cor.* 1. If a Body be of the ſame Weight at the end of a natural Day or any other Time, as at the beginning; the Quantity of Food taken in that Time, will be nearly proportional to the Quantity of Blood, which flows out of the Heart into the Aorta in the ſame Time. If d be o, F will be nearly proportional to q N.

*Cor.* 2. If a Body be of the ſame Weight at the end of a natural Day or any other Time, as at the beginning; and if during that Time, the mean Quantity of Blood flowing out of the Heart into the Aorta in one Syſtole be given; the Quantity of Food taken in that Time, will be nearly proportional to the Number of Pulſes in the ſame Time. If d be o, and q be given; F will be nearly proportional to N.

*Cor.*

*Cor.* 3. If the mean Quantity of Blood, which in a natural Day or any other Time flows out of the Heart into the Aorta in one Syſtole, be reciprocally proportional to the Number of Pulſes in that Time, and if the Body be of the ſame Weight at the end of the Time as at the beginning; then will the Quantity of Food be nearly given. If q be as $\frac{1}{N}$, and d be o, F will be nearly as 1.

*Cor.* 4. If the Heart during a natural Day or any other Time, throws the ſame Quantity of Blood into the Aorta in each Syſtole; if the Number of Pulſes in that Time, be proportional to the Morning Number of Pulſes in a Minute when the Body is ſitting, and its Heart is free from the Influences of all diſturbing Cauſes; and if the Body be of the ſame Weight at the end of the Time as at the beginning; then will the Quantity of Food taken in that Time, be nearly proportional to the Morning Number of Pulſes

in a Minute when the Body is sitting, and its Heart is free from the Influences of all disturbing Causes. If q be given, N be as P, and d be o; F will be as P.

I now proceed to an Explanation of the following Statical Tables, and Tables of Animals. But before I do this, I shall mention a few Particulars relating to myself.

I am now, in *May* 1747, in the 68th Year of my Age. The Length of my Body is 63 Inches: I am of a sanguin but not robust Constitution, and at present am neither lean nor fat. In the Year 1721, the Morning Weight of my Body without Cloaths was about 131 Averdupois Pounds, the daily Quantity of my Food at a Medium was about 85 Averdupois Ounces, and the Proportion of my Drink to my Meat, I judge was at that Time about 2.5 to 1. At the latter end of *May* 1744, my Weight was above 164 Pounds, and the Proportion of my Drink to my Meat was considerably greater than before, and had been so for some

Time.

Time. I was then ſeized with a paralytick Diſorder, which obliged me to make an Alteration in my Diet. In order to ſettle the Proportion of my Drink to my Meat, I conſidered what others have ſaid concerning this Proportion. According to *Sanctorius*, though he reckons it a Diſproportion, the Drink to the Meat in his Time, was above 10 to 3 in temperate Bodies, *Aph.* 68. *Sect.* 3. *Cornaro*'s Drink to his Meat, was as 7 to 6; Mr. *Rye*'s in Winter, as 4 to 3; Dr. *Lining*'s at a Medium for a whole Year, as 11 to 3; and my Drink to my Meat, as 5 to 2. A Mean taken from all theſe makes the Drink to the Meat to be as 2176 to 1000, which is above 2 to 1. I kept near to the Proportion of 2 to 1 in the Experiments, from which I compoſed Table 2. In 17 Months, from the Time I was ſeized to the End of *October* 1745, I loſt above twenty Pounds of my Weight, and above twice as much in the firſt five Months as I did in the twelve Months after. To this Loſs of Weight cauſed chiefly by the Regulation of my Diet, I impute my Recovery from

my laft Diforder, excepting which, and a Vertigo I had about ten or twelve Years before, I have had no Diforder of Confe-qnence, or that confined me, fince I was a Boy.

### *Explanation of the Tables.*

TABLE 1 is the fame with the Table publifhed in the *Animal Oeconomy*, p. 259, and contains the daily Food and daily Difcharges taken at a Medium from the Experiments of eight Months, beginning with *April* the laft of the Spring Months, and ending with *November* the firft of the Winter Months. In this Table the natural Day was divided into three Parts, Morning, Afternoon, and Night; the Morning contained fix Hours from eight to two, the Afternoon fix Hours from two to eight, and the Night the remaining twelve Hours. The Day made up of Morning and Afternoon, was equal to the Night. I obferved the Food and Difcharges in thefe three Parts of the natural Day, every Day for eight Months, and

and with the Means taken from all the Food and all the Diſcharges in the ſeveral Months, I compoſed this Table. The Numbers expreſſing the Food and the Diſcharges are Averdupois Ounces. p expreſſes the mean Quantity of Perſpiration, and u the mean Quantity of Urine, diſcharged daily in each Month; and conſequently, the Numbers in the Column $\frac{p}{u}$, both in this and all the following Tables, expreſs the Proportions of Perſpiration to Urine in the ſeveral Months, or expreſs Perſpiration, Urine being always expreſſed by 1; for Inſtance, Perſpiration was to Urine in *April*, as 0.904 to 1, or as 904 to 1000; and in *Auguſt* Perſpiration was to Urine, as 1.713 to 1, or as 1713 to 1000. This Table was made in the Year 1721.

*Table* 2 was made from the Experiments of a whole Year, beginning the firſt of *November* 1744, and ending with *October* 1745. In this Table the Day contained the Hours of my being up, and the

the Night the Hours of my being in Bed. For the firft feven Months to the Beginning of *June*, the Time of my being up was fifteen Hours, and the Time of my being in Bed nine Hours; and for the laft five Months to the End of *October*, the Time of my being up was 14.5 Hours, and the Time of my being in Bed 9.5 Hours. The Food and Difcharges in this and all the other Tables, are expreffed in Averdupois Ounces. For whenever any other Ounce was ufed, as the *Venetian* Ounce in *Italy* by *Sanctorius*, and the Troy Ounce in *South Carolina* by Dr. *Lining*, I reduced it to the Averdupois Ounce, for the more eafy comparing of the Quantities of Food, and Quantities of the Difcharges, of Perfons living in different Climates. The *Venetian* Pound, according to Mr. *Greaves*, contains 5528 Grains, and the *Venetian* Ounce 460$\frac{2}{3}$ Grains; Dr. *Lining*'s Pound contains 16 Troy Ounces, or 7680 Grains; and the Averdupois Pound ufed by Dr. *Kiell*, Mr. *Rye*, and myfelf, contains 7000 Grains, and the Ounce 437$\frac{1}{2}$ Grains.

*Table*

*Table* 3 conſiſts of two Parts. The firſt Part was made from *Table* 1, and the ſecond Part from *Table* 2. Each Part contains the mean Quantities of Food taken daily in the ſeveral Months and Seaſons of the Year; and the mean Quantities of Urine and Perſpiration, which were drawn off from the Blood hourly in the Day and in the Night. In the firſt Part of the *Table*, the Day was twelve Hours, and the Night twelve Hours; and conſequently T was 12 both Day and Night. In the ſecond Part of the *Table*, the Day and Night being the Times of my being up and in Bed, which were 15 and 9 in the firſt ſeven Months, and 14.5 and 9.5 in the laſt five Months; T was 15 in the Day, and 9 in the Night in the firſt ſeven Months; and 14.5 in the Day, and 9.5 in the Night, in the laſt five Months. For Example, the mean Quantity of Urine diſcharged daily in *November*, was 20.4 Ounces in the firſt Part of the *Table*, and 17.96 Ounces in the ſecond Part; and dividing 20.4 by 12, and

17.96

17.96 by 15, we have 1.700, and 1,197, the mean Quantities of Urine difcharged hourly in the Day in that Month. And the mean Quantity of Perfpiration difcharged daily in that Month was 17.63 in the firft Part of the *Table*, and 20.32 in the fecond Part; and dividing 17.63 by 12, and 20.32 by 15, the Quotients 1.470 and 1.355 will be the mean Quantities of Perfpiration difcharged hourly in the Day in that Month. In like manner were got the mean hourly Difcharges of Urine and Perfpiration in the Night: And thus the whole *Table* was formed.

*Table* 4 is the fame with the *Table* in p. 277 of the *Animal Oeconomy*, and contains the mean Quantities of Perfpiration and Urine which were actually difcharged hourly by two Perfons B and D, myfelf and another, in four very hot Days in Summer, beginning at fix in the Morning, and ending at ten at Night. The Numbers correfponding to fix in the Morning, were the Quantities of Perfpiration and Urine which were drawn off from

from the Blood in every Hour of the Night, taking one Hour with another. We both eat our Breakfaſt at eight in the Morning, dined at two, and ſupped at eight at Night. The mean Quantities of our daily Food in theſe four Days, were 86 and 63 Averdupois Ounces. We both kept within, and uſed no Exerciſe during that Time.

*Table* 5 was made from *Table* 4, and contains the mean Quantities of the Food of B and D in a natural Day; and the mean Quantities of Perſpiration and Urine, and the Proportion of the mean Quantity of Perſpiration to the mean Quantity of Urine, in the three equal Parts of the natural Day, Morning, Afternoon, and Night; ſuppoſing the Morning to begin at ſix and end at two, the Afternoon to begin at two and end at ten, and the Night to begin at ten and end at ſix next Morning.

*Table* 6 was made from the particular Tables of the Months, from the Means

of which Tables I compofed Table 2; and it contains feveral of the moft remarkable Changes of my Weight, together with my Food and Difcharges on thofe Days in which the Changes happened. The firft Column contains the Names of the Months; the fecond contains the Days of the Months on which the Changes happened; the third contains the Quantities of Food taken on thofe Days; the fourth contains the Gain or Lofs of Weight, Gain being denoted by —, and Lofs by +; the fifth contains the Sum of the Difcharges on thofe Days by Perfpiration, Urine and Stool, which Difcharges are fet down feparately in the fixth, feventh and eighth Columns; and the ninth Column contains the Proportion of Perfpiration to Urine.

*Tables* 7, 8, 9, are the yearly *Tables*, of Dr. *Keill* at *Northampton* in *England*, of Mr. *Rye* at *Cork* in *Ireland*, and of Dr. *Lining* at *Charles-town* in *South Carolina*. In Dr. *Lining*'s Table, d and n exprefs Day and Night; and p and u Perfpiration

tion and Urine as in the other *Tables*; for Inſtance, $\frac{d\,u}{n\,u}$ expreſſes the Proportion of the Day's Urine to the Night's Urine, and $\frac{d\,p}{n\,p}$ the Proportion of the Day's Perſpiration to the Night's Perſpiration. I have reduced his Degrees of Heat to the Scale of Sir *Iſaac Newton*.

*Table* 10 contains the Quantities of Food in Averdupois Ounces, and the Proportions of Perſpiration to Urine in the four Seaſons of the Year, in *Italy*, *England*, *Ireland*, and *South Carolina*.

*Sanctorius* tells us, that if the Meat and Drink of one Day be eight Pounds, inſenſible Perſpiration is wont to riſe to about five Pounds. *Aph.* 6. *Sect.* 1. And conſequently, there will remain three Pounds to be diſcharged by Urine and Stool, thirty-two Ounces by Urine, and four Ounces by Stool. *Aph.* 59, 60. *Sect.* 1. Theſe Quantities of Perſpiration and Urine, muſt be the Quantities diſcharged

in a natural Day in Summer, by *Aph.* 21. *Sect.* 1. And from these we may get the Quantities of Perspiration and Urine in a natural Day in Winter, by *Aph.* 41. *Sect.* 2. which Quantities will be 48 and 44. Hence in *Italy* Perspiration is to Urine in a natural Day in Summer as 1.870 is to 1, or as 1870 is to 1000; and in a natural Day in Winter Perspiration is to Urine as 1.090 is to 1, or as 1090 is to 1000. The Sums of the Proportions of Perspiration to Urine in Summer and Winter, divided by 2, will nearly give their Proportion in Spring and Autumn; which therefore will be as 1.480 is to 1, or as 1480 is to 1000.

# STATICAL TABLES.

## TABLE I.

Dr. ROBINSON, Aged 42, A. D. 1721.

| Months. | Food. Break | Food. Dinn. | Food. Supp. | Food. Whole | Morning. Urine | Morning. Persp. | Afternoon. Urine | Afternoon. Persp. | Night. Urine | Night. Persp. | Whole Urine | Whole Persp. | Stool | Whole Disch. | $\frac{p}{u}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| April | 23.37 | 44.00 | 16.22 | 83.59 | 8.38 | 11.00 | 17.40 | 11.26 | 16.59 | 16.05 | 42.37 | 38.31 | 5.27 | 85.95 | 0.904 |
| May | 23.30 | 47.35 | 21.62 | 92.27 | 7.18 | 13.12 | 17.77 | 11.62 | 16.75 | 19.52 | 41.70 | 44.26 | 7.42 | 93.38 | 1.061 |
| June | 27.20 | 48.13 | 15.10 | 90.43 | 7.13 | 15.68 | 12.10 | 12.70 | 14.53 | 22.77 | 33.76 | 51.15 | 5.32 | 90.23 | 1.515 |
| July | 25.98 | 41.12 | 15.53 | 82.63 | 7.78 | 14.83 | 10.30 | 12.28 | 12.30 | 19.32 | 30.38 | 46.43 | 5.85 | 82.66 | 1.528 |
| August | 22.04 | 43.10 | 20.54 | 85.68 | 7.35 | 17.42 | 10.00 | 13.15 | 12.58 | 20.69 | 29.93 | 51.27 | 4.48 | 85.68 | 1.713 |
| Septem. | 18.72 | 48.00 | 19.74 | 86.46 | 7.50 | 13.48 | 13.12 | 11.02 | 15.50 | 19.93 | 36.12 | 44.43 | 5.15 | 85.70 | 1.230 |
| October | 18.85 | 45.88 | 15.68 | 80.42 | 7.20 | 9.98 | 13.72 | 10.10 | 16.68 | 17.52 | 37.60 | 37.60 | 5.05 | 80.25 | 1.000 |
| Novem. | 22.38 | 40.92 | 15.06 | 78.37 | 7.65 | 8.94 | 12.75 | 8.69 | 16.69 | 18.02 | 37.09 | 35.65 | 4.71 | 77.45 | 0.961 |
| Mean | 22.73 | 44.81 | 17.44 | 84.98 | 7.52 | 13.06 | 13.39 | 11.35 | 15.20 | 19.22 | 36.12 | 43.64 | 5.41 | 85.16 | 1.208 |
| Summer | 25.49 | 45.53 | 17.42 | 88.44 | 7.36 | 14.54 | 13.39 | 12.20 | 14.53 | 20.54 | 35.28 | 47.28 | 6.20 | 88.76 | 1.340 |
| Autumn | 19.87 | 45.66 | 18.65 | 84.18 | 7.35 | 13.63 | 12.28 | 11.42 | 14.92 | 19.38 | 34.55 | 44.43 | 4.89 | 83.87 | 1.286 |
| Mean | 22.68 | 45.59 | 18.03 | 86.31 | 7.35 | 14.08 | 12.83 | 11.81 | 14.72 | 19.97 | 34.91 | 45.86 | 5.54 | 86.31 | 1.315 |

## TABLE 2.

Dr. Robinson, Aged 64-5, A. D. 1744-5.

| Months. | Food. Meat | Food. Drink | Food. Whole | ±d | Urine Day. | Spec. Grav. | Urine Night | Spec. Grav. | Urine whole | Perfpiration. Day. | Perfpiration. Night | Perfpiration. Whole | Stool | Whole Difch. | $\frac{p}{u}$ | Pulfe in 1'. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Novem. | 18.77 | 41.73 | 60.50 | + 14 | 17.96 | 10252 | 12.22 | 10273 | 30.18 | 20.32 | 8.03 | 28.35 | 2.45 | 60.98 | 0.939 | 63 |
| Decem. | 20.05 | 41.98 | 62.03 | − 11 | 18.90 | 10260 | 11.76 | 10277 | 30.66 | 19.46 | 8.49 | 27.95 | 3.06 | 61.67 | 0.911 | 63 |
| January | 19.70 | 43 34 | 63.04 | + 66 | 17.75 | 10251 | 13.43 | 10255 | 31.18 | 18.07 | 9.22 | 27.29 | 6.67 | 65.14 | 0.875 | 66 |
| Febr. | 18.59 | 43.10 | 61.68 | − 4 | 14.91 | 10260 | 13.03 | 10266 | 27.94 | 17.07 | 9.55 | 26.62 | 7.01 | 61.57 | 0.953 | 65 |
| March | 20.80 | 39.90 | 60.70 | + 18 | 16.83 | 10250 | 12.13 | 10269 | 28.96 | 19.18 | 9.44 | 28.62 | 3.70 | 61.28 | 0.988 | 63 |
| April | 19.93 | 40.10 | 60.03 | + 7 | 17.00 | 10252 | 10.89 | 10275 | 27.89 | 21.86 | 7.86 | 29.73 | 2.64 | 60.26 | 1.066 | 62 |
| May | 19.39 | 36.93 | 56.32 | + 8 | 19.12 | 10256 | 9.05 | 10291 | 28.17 | 19.18 | 6.71 | 25.89 | 2.52 | 56.58 | 0.919 | 65 |
| June | 22.10 | 34.23 | 56.33 | − 13 | 16.20 | 10234 | 9.07 | 10256 | 25.27 | 19.51 | 8.12 | 27.63 | 3.00 | 55.90 | 1.093 | 66 |
| July | 22.50 | 33.79 | 56.29 | − 5 | 17.42 | 10247 | 10.37 | 10271 | 27.79 | 17.45 | 7.63 | 25.08 | 3.25 | 56.12 | 0.902 | 63.4 |
| Auguft | 22.04 | 34.38 | 56.42 | + 5 | 15.70 | 10234 | 10.25 | 10264 | 25.95 | 20.27 | 7.98 | 28.25 | 2.38 | 56.58 | 1.088 | 63.8 |
| Septem. | 20.53 | 35.06 | 55.60 | + 42 | 15.61 | 10236 | 10.13 | 10279 | 25.75 | 19 80 | 8.75 | 28.55 | 2.69 | 56.99 | 1.108 | 63.6 |
| October | 19.63 | 34.32 | 53.95 | − 6 | 15.77 | 10235 | 10.42 | 10272 | 26.19 | 18 34 | 7.16 | 25.50 | 2.08 | 53.77 | 0.973 | 60.4 |
| Mean | 20.33 | 38.24 | 58.57 | +121 | 16.93 | 10247 | 11.06 | 10270 | 27.99 | 19.21 | 8.24 | 27.45 | 3.45 | 58.89 | 0.980 | 63.6 |
| Winter | 19.51 | 42.35 | 61.86 | + 69 | 18.20 | 10254 | 12.47 | 10268 | 30.67 | 19.28 | 8.58 | 27.86 | 4.06 | 62.60 | 0.908 | 64 |
| Spring | 19.77 | 41.03 | 60.80 | + 21 | 16.25 | 10254 | 12.02 | 10270 | 28.27 | 19.37 | 8.95 | 28.32 | 4.45 | 61.04 | 1.002 | 63 |
| Summer | 21.33 | 34.98 | 56.31 | − 10 | 17.58 | 10246 | 9.50 | 10273 | 27.08 | 18.71 | 7.49 | 26.20 | 2.92 | 56.20 | 0.967 | 64.8 |
| Autumn | 20.73 | 34.59 | 55.32 | + 41 | 15.69 | 10235 | 10.26 | 10272 | 25.96 | 19.47 | 7.96 | 27.43 | 2.38 | 55.77 | 1.057 | 62.6 |
| Mean | 20.33 | 38.24 | 58.57 | +121 | 16.93 | 10247 | 11.06 | 10270 | 27.99 | 19.21 | 8.24 | 27.45 | 3.45 | 58.89 | 0.980 | 63.6 |

## TABLE 3.

| Months. | A. D. 1721. | | | | | A. D. 1744-5. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | $\frac{u}{T}$ | | $\frac{p}{T}$ | | | $\frac{u}{T}$ | | $\frac{p}{T}$ | |
| | Food. | Day. | Night | Day. | Night | Food. | Day. | Night | Day. | Night |
| November | 78.37 | 1.700 | 1.391 | 1.470 | 1.502 | 60.50 | 1.197 | 1.358 | 1.355 | 0.892 |
| December | | | | | | 62.03 | 1.260 | 1.307 | 1.297 | 0.943 |
| January | | | | | | 63.04 | 1.183 | 1.492 | 1.205 | 1.024 |
| February | | | | | | 61.68 | 0.994 | 1.448 | 1.138 | 1.061 |
| March | | | | | | 60.70 | 1.122 | 1.348 | 1.279 | 1.049 |
| April | 83.59 | 2.148 | 1.382 | 1.855 | 1.338 | 60.03 | 1.133 | 1.210 | 1.457 | 0.873 |
| May | 92.27 | 2.079 | 1.396 | 2.062 | 1.627 | 56.32 | 1.274 | 1.006 | 1.279 | 0.745 |
| June | 90.43 | 1.602 | 1.211 | 2.365 | 1.897 | 56.33 | 1.117 | 0.955 | 1.345 | 0.855 |
| July | 82.63 | 1.507 | 1.025 | 2.260 | 1.610 | 56.29 | 1.201 | 1.091 | 1.203 | 0.803 |
| August | 85.68 | 1.446 | 1.048 | 2.547 | 1.724 | 56.42 | 1.083 | 1.079 | 1.398 | 0.840 |
| September | 86.46 | 1.718 | 1.291 | 2.042 | 1.661 | 55.60 | 1.076 | 1.066 | 1.365 | 0.921 |
| October | 80.42 | 1.743 | 1.390 | 1.673 | 1.460 | 53.95 | 1.088 | 1.097 | 1.265 | 0.753 |
| Mean | 84.98 | 1.742 | 1.267 | 2.034 | 1.602 | 58.57 | 1.144 | 1.202 | 1.298 | 0.896 |
| Winter | | | | | | 61.86 | 1.213 | 1.385 | 1.285 | 0.953 |
| Spring | | | | | | 60.80 | 1.083 | 1.335 | 1.291 | 0.994 |
| Summer | 88.44 | 1.729 | 1.211 | 2.229 | 1.712 | 56.31 | 1.197 | 1.018 | 1.273 | 0.805 |
| Autumn | 84.19 | 1.635 | 1.243 | 2.088 | 1.615 | 55.32 | 1.082 | 1.080 | 1.343 | 0.838 |
| Mean | 86.31 | 1.682 | 1.227 | 2.158 | 1.664 | 58.57 | 1.144 | 1.202 | 1.298 | 0.896 |

TABLE 4.

| Hours. | B Persp. | B Urine | D Persp. | D Urine |
|---|---|---|---|---|
| 6 | 1.875 | 0.937 | 2.000 | 1.000 |
| 7 | 1.833 | 1.000 | 1.400 | 1.000 |
| 8 | 2.000 | 1.000 | 1.500 | 1.200 |
| 9 | 2.000 | 1.166 | 1.800 | 1.300 |
| 10 | 2.000 | 1.500 | 1.900 | 1.000 |
| 11 | 1.750 | 1.000 | 1.400 | 1.000 |
| 12 | 2.333 | 1.000 | 1.800 | 1.000 |
| 1 | 2.333 | 1.250 | 1.500 | 1.000 |
| 2 | 2.000 | 1.000 | 1.500 | 1.000 |
| 3 | 3.500 | 1.500 | 2.000 | 1.000 |
| 4 | 2.333 | 2.000 | 1.500 | 1.143 |
| 5 | 2.333 | 2.000 | 1.800 | 1.000 |
| 6 | 2.666 | 2.000 | 2.000 | 1.000 |
| 7 | 2.000 | 2.000 | 2.000 | 1.000 |
| 8 | 2.333 | 2.333 | 2.000 | 1.000 |
| 9 | 2.333 | 1.666 | 1.500 | 1.500 |
| 10 | 2.333 | 1.666 | 1.500 | 1.500 |

TABLE 5.

| Men | F | Morning. p | u | $\frac{p}{u}$ | Afternoon. p | u | $\frac{p}{u}$ | Night. p | u | $\frac{p}{u}$ | Whole. p | u | $\frac{p}{u}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B | 86 | 16.249 | 8.916 | 1.822 | 19.831 | 15.165 | 1.307 | 15.000 | 7.496 | 2.001 | 51.080 | 31.577 | 1.618 |
| D | 63 | 12.800 | 8.500 | 1.506 | 14.300 | 9.143 | 1.564 | 16.000 | 8.000 | 2.000 | 43.100 | 25.643 | 1.681 |

TABLE 6.

| Months | Day. | Food | ±d | Disch. | Urine | Persp. | Stool. | $\frac{p}{u}$ |
|---|---|---|---|---|---|---|---|---|
| Nov. | 18 | 61.0 | +29 | 90.0 | 49.00 | 38.00 | 3.00 | 0.775 |
| Dec. | 13 | 62.0 | +11 | 73.0 | 41.00 | 28.05 | 3.05 | 0.695 |
| | 14 | 67.0 | + 6 | 73.0 | 41.00 | 29.00 | 3.00 | 0.707 |
| | 28 | 54.0 | +17 | 71.0 | 34.00 | 34.00 | 3.00 | 1.000 |
| Janu. | 2 | 62.0 | +37 | 99.0 | 31.25 | 40.75 | 27.00 | 1.304 |
| | 25 | 40.5 | +26 | 66.5 | 34.05 | 28.00 | 4.00 | 0.811 |
| | 30 | 82.0 | + 7 | 89.0 | 31.75 | 24.05 | 32.75 | 0.771 |
| | 31 | 61.5 | +32 | 93.5 | 28.05 | 30.00 | 35.00 | 1.052 |
| Febr. | 1 | 64.5 | +24 | 88.5 | 18.00 | 23.25 | 47.25 | 1.291 |
| | 16 | 58.0 | + 7 | 65.0 | 23.05 | 28.75 | 2.75 | 0.831 |
| | 17 | 81.0 | + 0 | 81.0 | 31.75 | 28.25 | 21.00 | 0.890 |
| March | 17 | 66.0 | —15 | 51.0 | 26.50 | 22.00 | 2.05 | 0.830 |
| | 30 | 20.0 | +28 | 48.0 | 21.50 | 26.25 | 0.00 | 1.232 |
| April | 24 | 59.0 | +15 | 74.0 | 31.05 | 40.25 | 2.25 | 1.262 |
| | 25 | 64.0 | —14 | 50.0 | 21.05 | 28.05 | 0.00 | 1.325 |
| May | 20 | 23.0 | +26 | 49.0 | 27.05 | 20.25 | 1.25 | 0.736 |
| | 25 | 23.0 | +36 | 59.0 | 33.00 | 23.25 | 2.75 | 0.705 |
| June | 3 | 60.0 | +12 | 72.0 | 27.00 | 41.75 | 3.25 | 1.546 |
| | 13 | 47.0 | +21 | 68.0 | 24.05 | 31.50 | 12.00 | 1.286 |
| | 30 | 54.0 | —17 | 37.0 | 22.75 | 11.05 | 2.75 | 0.505 |
| July | 12 | 13.0 | +28 | 41.0 | 22.00 | 17.05 | 1.50 | 0.795 |
| | 28 | 24.0 | +30 | 54.0 | 24.05 | 27.25 | 2.25 | 1.112 |
| August | 6 | 77.0 | —25 | 52.0 | 21.25 | 24.25 | 6.50 | 1.139 |
| | 8 | 34.0 | +25 | 59.0 | 20.05 | 31.05 | 7.00 | 1.536 |
| Sept. | 7 | 70.0 | —20 | 50.0 | 22.00 | 28.00 | 0.00 | 1.272 |
| | 8 | 27.0 | +26 | 53.0 | 24.05 | 26.00 | 2.50 | 1.061 |
| Octob. | 30 | 69.0 | —21 | 48.0 | 22.25 | 21.05 | 4.50 | 0.955 |

## TABLE 7.

### Dr. KEILL, Aged 39, A. D. 1717-18.

| Months. | Weight | Food. | Urine Day. | Urine Night | Perspiration. Day. | Perspiration. Night | Total Urine | Total Persp. | $\frac{p}{u}$ |
|---|---|---|---|---|---|---|---|---|---|
| | lb. | oz. | oz. | oz. | oz. | oz. | oz. | oz. | |
| July | 154.09 | 74.62 | 18.54 | 17.98 | 18.98 | 15.95 | 36.52 | 34.93 | 0.957 |
| August | 153.75 | 78.00 | 17.27 | 13.76 | 18.31 | 13.12 | 31.03 | 31.43 | 1.013 |
| September | 154.60 | 76.00 | 16.00 | 18.00 | 18.73 | 13.25 | 34.00 | 31.98 | 0.941 |
| October | 155.99 | 68.87 | 21.86 | 15.55 | 16.26 | 11.40 | 37.41 | 27.66 | 0.739 |
| November | 155.85 | 64.61 | 22.02 | 17.17 | 18.18 | 10.50 | 39.19 | 28.68 | 0.732 |
| December | 154.84 | 63.17 | 18.97 | 14.42 | 16.18 | 11.21 | 33.39 | 27.38 | 0.820 |
| January | 153.77 | 63.12 | 23.68 | 14.51 | 17.72 | 11.53 | 38.19 | 29.25 | 0.766 |
| February | 154.80 | 83.25 | 20.66 | 16.34 | 20.14 | 10.20 | 37.00 | 30.34 | 0.820 |
| March | 155.93 | 94.33 | 28.58 | 19.07 | 16.18 | 10.70 | 47.65 | 26.88 | 0.564 |
| April | 155.38 | 67.25 | 25.04 | 19.99 | 18.52 | 11.41 | 45.03 | 29.93 | 0.664 |
| May | 155.96 | 84.67 | 16.58 | 21.10 | 22.46 | 13.37 | 37.68 | 35.83 | 0.951 |
| June | 158.76 | 84.64 | 19.31 | 18.41 | 24.00 | 13.38 | 37.72 | 37.38 | 0.991 |
| Mean | 155.31 | 75.21 | 20.71 | 17.19 | 18.80 | 12.17 | 37.90 | 30.97 | 0.817 |
| Summer | 156.27 | 81.31 | 18.14 | 19.16 | 21.81 | 14.23 | 37.30 | 36.04 | 0.966 |
| Autumn | 154.78 | 74.29 | 18.38 | 15.77 | 17.77 | 12.59 | 34.15 | 30.36 | 0.889 |
| Winter | 154.82 | 63.63 | 21.55 | 15.37 | 17.36 | 11.08 | 36.92 | 28.44 | 0.770 |
| Spring | 155.37 | 81.61 | 24.76 | 18.47 | 18.28 | 10.77 | 43.23 | 29.05 | 0.672 |
| Mean | 155.31 | 75.21 | 20.71 | 17.19 | 18.80 | 12.17 | 37.90 | 30.97 | 0.817 |

## TABLE 8.

Mr. Rye, Aged 42, A. D. 1721-2.

| Months. | Weight. | Food. | Urine Day. | Urine Night | Total Urine | Total Perfp. | $\frac{p}{u}$ |
|---|---|---|---|---|---|---|---|
| | lb. | oz. | oz. | oz. | oz. | oz. | |
| May | 196.56 | 102.41 | 21.96 | 18.76 | 40.72 | 61.10 | 1.500 |
| June | 197.12 | 97.91 | 20.60 | 16.00 | 36.60 | 60.23 | 1.645 |
| July | 197.62 | 94.23 | 19.60 | 15.73 | 35.33 | 58.83 | 1.665 |
| Auguft | 197.75 | 99.66 | 18.15 | 15.25 | 33.40 | 66.60 | 1.994 |
| September | 196.50 | 96.54 | 19.54 | 15.73 | 35.27 | 57.77 | 1.638 |
| October | 195.81 | 90.12 | 21.68 | 17.19 | 38.87 | 49.56 | 1.275 |
| November | 197.69 | 87.93 | 21.87 | 17.77 | 39.64 | 47.37 | 1.195 |
| December | 199.44 | 89.12 | 21.64 | 19.48 | 41.12 | 53.72 | 1.306 |
| January | 197.25 | 94.73 | 20.73 | 18.80 | 39.53 | 50.13 | 1.268 |
| February | 200.81 | 94.98 | 22.48 | 17.95 | 40.43 | 55.14 | 1.364 |
| March | 200.47 | 100.53 | 20.93 | 19.07 | 40.00 | 56.87 | 1.422 |
| April | 196.53 | 108.57 | 22.86 | 17.96 | 40.82 | 62.61 | 1.534 |
| Mean | 197.80 | 96.39 | 21.00 | 17.47 | 38.47 | 56.66 | 1.472 |
| Summer | 197.10 | 98.18 | 20.72 | 16.83 | 37.55 | 60.05 | 1.600 |
| Autumn | 196.69 | 95.44 | 19.79 | 16.06 | 35.85 | 57.98 | 1.617 |
| Winter | 198.13 | 90.59 | 21.41 | 18.68 | 40.09 | 50.41 | 1.257 |
| Spring | 199.27 | 101.36 | 22.09 | 18.33 | 40.42 | 58.21 | 1.440 |
| Mean | 197.80 | 96.39 | 21.00 | 17.47 | 38.47 | 56.66 | 1.472 |

# TABLE 9.

## Dr. LINING, A. D. 1739-40.

| Months. | Food. Meat | Drink. | Whole | ±d | Discharges. Urine | Perſp. | Stool | Whole | $\frac{d\,u}{n\,u}$ | $\frac{d\,p}{n\,p}$ | $\frac{d\,p}{d\,u}$ | $\frac{n\,p}{n\,u}$ | $\frac{p}{u}$ | Ba-rom. | Heat by N'sScal | Moiſt of Air | Rain. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| March | 27.75 | 101.03 | 128.78 | − 3.6 | 77.26 | 47.48 | 3.92 | 128.66 | 1.215 | 1.105 | 0.596 | 0.655 | 0.614 | 30.00 | 4.69 | 12 | 1.141 |
| April | 26.51 | 93.11 | 119.62 | + 39.6 | 64.55 | 52.74 | 3.65 | 120.94 | 1.329 | 1.275 | 0.794 | 0.830 | 0.817 | 30.03 | 6.56 | 7 | 1.092 |
| May | 28.94 | 100.43 | 129.37 | + 12.3 | 61.69 | 64.35 | 3 74 | 129.78 | 0.842 | 1.545 | 1.252 | 0.683 | 1.043 | 30.10 | 7.87 | 9 | 5.612 |
| June | 24.84 | 112.89 | 137.73 | + 69.0 | 57.55 | 78.33 | 4.15 | 140.03 | 0.789 | 1.631 | 1.705 | 0.825 | 1.361 | 30.09 | 8.81 | 10 | 4.648 |
| July | 26.80 | 120.34 | 147.14 | + 10.8 | 47.82 | 95.36 | 4.32 | 147.50 | 0.623 | 2.151 | 2.964 | 0.879 | 1.994 | 30.10 | 9.19 | 11 | 3.013 |
| Auguſt | 27.65 | 115.44 | 143.09 | + 4.8 | 60.79 | 77.80 | 4.65 | 143.25 | 0.725 | 2.115 | 1.717 | 0.592 | 1.280 | 29.60 | 8.44 | 12 | 7.301 |
| Septem. | 25.70 | 104.00 | 129.70 | +111.9 | 43.95 | 84.58 | 4.90 | 133.43 | 0.862 | 2.039 | 2.142 | 0.906 | 1.924 | 30.11 | 8.06 | 12 | 3.200 |
| October | 26.31 | 80.00 | 106.31 | − 72.9 | 52.34 | 44.76 | 6.78 | 103.88 | 0.722 | 1.049 | 1.003 | 0.700 | 0.855 | 30.22 | 4.50 | 12 | 1.257 |
| Novem. | 29.33 | 90.94 | 120.27 | − 91.8 | 68.84 | 44.36 | 4.00 | 117.21 | 1.215 | 1.072 | 0.630 | 0.714 | 0.644 | 30.24 | 3.75 | 14 | 1.848 |
| Decem. | 29 50 | 100.44 | 129.94 | − 48.0 | 77.55 | 46.69 | 4.10 | 128.34 | 1.310 | 1.468 | 0.632 | 0.563 | 0.602 | 30.11 | 1.87 | 10 | 2.736 |
| January | 25.94 | 104.35 | 130.29 | − 58.0 | 80.18 | 43.68 | 4.50 | 128.36 | 1.618 | 1.369 | 0.532 | 0.859 | 0.545 | 30.09 | 2.45 | 18 | 4.492 |
| Febr. | 26.91 | 103.06 | 129.97 | + 6.6 | 85.59 | 41.08 | 3.53 | 130.19 | 1.723 | 1.379 | 0.449 | 0.568 | 0.480 | 30.25 | 2.62 | 16 | 3.135 |
| Mean | 27.18 | 102.17 | 129.35 | − 19.3 | 64.84 | 60.10 | 4.35 | 129.30 | 1.081 | 1.516 | 1.201 | 0 731 | 0.927 | 30.08 | 5.73 | 11.9 | 3.289 |
| Spring | 27.05 | 99.06 | 126.11 | + 42.6 | 75.80 | 47.10 | 3.70 | 126.60 | 1.422 | 1.253 | 0.613 | 0.684 | 0.621 | 30.09 | 4.62 | 11.66 | 1.789 |
| Summer | 26.86 | 111.22 | 138.08 | + 92.1 | 55.69 | 79.35 | 4.07 | 139.11 | 0.751 | 1.776 | 1.974 | 0.796 | 1.425 | 30.10 | 8.62 | 10.00 | 4.424 |
| Autumn | 26.55 | 99.81 | 126.36 | + 43.8 | 52.36 | 69.05 | 5 44 | 126 85 | 0.770 | 1.737 | 1.621 | 0.733 | 1.318 | 29.97 | 7.00 | 12.00 | 3.919 |
| Winter | 28.26 | 98.58 | 126.84 | −197.8 | 75.52 | 44.91 | 4.20 | 124.63 | 1.381 | 1.303 | 0.598 | 0.712 | 0.595 | 30.15 | 2.69 | 14.00 | 3.025 |
| Mean | 27.18 | 102.17 | 129.35 | − 19.3 | 64.84 | 60.10 | 4.35 | 129.29 | 1.081 | 1.517 | 1.201 | 0.731 | 0.927 | 30.08 | 5.73 | 11.91 | 3.289 |

# TABLE 10.

| | Italy. | | England. | | Cork. | | Ireland. Dublin, 1721 | | Dublin, 1744 | | South Carolina. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Seasons. | Food. | $\frac{p}{u}$ | Food. | $\frac{p}{u}$ | Food. | $\frac{p}{u}$ | Food. | $\frac{p}{u}$ | Food. | $\frac{p}{u}$ | Food. | $\frac{p}{u}$ |
| Spring | 101.08 | 1.480 | 81.61 | 0.672 | 101.36 | 1.440 | | | 60.80 | 1.002 | 126.11 | 0.621 |
| Summer | 101.08 | 1.870 | 81.31 | 0.966 | 98.18 | 1.600 | 88.44 | 1:340 | 56.31 | 0.967 | 138.08 | 1.425 |
| Autumn | 101.08 | 1.480 | 74.29 | 0.889 | 95.44 | 1.617 | 84.18 | 1.286 | 55.32 | 1.057 | 126.36 | 1.318 |
| Winter | 101.08 | 1.090 | 63.63 | 0.770 | 90.59 | 1.257 | | | 61.86 | 0.908 | 126.84 | 0.595 |
| Mean | 101.08 | 1.480 | 75.21 | 0.817 | 96.39 | 1.472 | 86.31 | 1.141 | 58.57 | 0.980 | 129.35 | 0.927 |

## *Obfervations on the foregoing Tables.*

OBS. 1. By Table 1, the Heat and Cold of the Air affect Perfpiration and Urine in a different manner; Heat increafes Perfpiration and leffens Urine, and Cold on the contrary leffens Perfpiration and increafes Urine. In *April* and *May* thefe two Difcharges were nearly equal, only Urine exceeded Perfpiration a little in *April*, and was exceeded by it a little in *May*. In the three Months *June*, *July*, and *Auguft*, Perfpiration exceeded Urine in the proportion of above 1.5 to 1, or 15 to 10. Perfpiration was greateft, and Urine leaft, in *Auguft*. In *September* Perfpiration leffened and Urine increafed. And in *October* and *November* they were nearly equal again, only Urine exceeded Perfpiration a little in *November*. At the End of this Month I was interrupted, and hindered from carrying on the Experiments to the End of the Year, as I at firft intended; but I repeated them for about ten Days in cold frofty Weather, and found

found that Urine then exceeded Perſpiration as much as Perſpiration exceeded Urine in Summer. Hence, ſuppoſing the Quantity of Food, and the proportion of the Drink to the Meat, to have been the ſame in Winter as in Summer; the proportion of Perſpiration to Urine in Summer would have been greater than the proportion of Perſpiration to Urine in Winter, nearly in the proportion of 18 to 10.

*Obſ.* 2. By comparing the Food and the Diſcharges of the whole eight Months of Table 1, it appears that they were very nearly equal in a natural Day, taking one Day of that whole Time with another. For taking one Day with another, the daily Diſcharges exceeded the daily Food by only the 0.18th part of an Ounce, which is not a Quarter of an Ounce Averdupois. This daily Loſs of Weight, though ſmall, yet in the whole eight Months, or 244 Days, amounted to 43.92 Ounces; that is, to near two Pounds and a half. It is natural for Bodies to fall

fall away in Summer. *Sanctorius* says, that temperate Bodies are lighter in Summer than in Winter by about three Pounds, that is, by near thirty-eight Averdupois Ounces. A Change in the Weight of a Body at different Seasons of the Year, arises from an inequality between the Quantity of Food and Sum of the Discharges in those Seasons. When a Body gains in Weight, the Food exceeds the Discharges; and when it loses in Weight, the Discharges exceed the Food. If therefore from a given Quantity of Food a Body be lighter in Summer than in Winter, the Discharges exceed the Food in Summer, and fall short of the Food in Winter. Consequently, in Summer Perspiration is more increased than Urine is lessened, and Perspiration more lessened than Urine is increased in Winter; whereas to keep a Body always of the same Weight, the Increase or Decrease of Perspiration must be ever equal to the Decrease or Increase of Urine, supposing the Quantity of Stool to be always the same. Hence, the Heat and Cold of the Air

first

firſt affect the Surface of the Body, and increaſe or leſſen Perſpiration; and afterwards, in ſome little Time, the Increaſe or Diminution of Perſpiration is attended with an equal Diminution or Increaſe of Urine. Whence, the Body from a given Quantity of Food neceſſarily becomes lighter in Summer than in Winter, when the Air is hot than when it is cold; ſuppoſing the Quantity of Stool, which is a very ſmall Diſcharge when compared with Perſpiration and Urine, to be much the ſame in Summer and in Winter, as it is found to be in regular and temperate Bodies. This Property of Perſpiration and Urine is cauſed by a Difference in the Motion of the Blood, at the Surface of the Body and in its inward Parts, at the Skin and in the Kidneys, in theſe two different Seaſons of the Year. The Heat of the Air acting on the Surface of the Body, ſwells the Veſſels of the Skin, Blood-veſſels and ſecerning Ducts, and increaſes the Motion of their reſpective Fluids through them; but when the Motion of the animal Fluids, Blood and ſecerned

Humours, is increafed in one Part, it is leffened in the other Parts in healthful Bodies, when it is increafed in the Skin, it is leffened in the Kidneys, by *Prop.* 19. *Anim. Oecon.* and therefore when Perfpiration is increafed or leffened by the Heat or Cold of the Air, Urine is leffened or increafed equally, but not at the very fame Time the Change is made in Perfpiration; for all Changes of Motion in the animal Fluids are gradual; and confequently, when the Motion of the Blood is increafed at the Skin, it will require fome Time to be equally leffened in the Kidneys. Hence, from the Nature of the Blood's Motion, the Weight of a healthful Body is lefs in Summer than in Winter. But though the Weight of the Body, and the Proportion of Perfpiration to Urine, be both changed by the Heat and Cold of the Air, yet will thefe Changes be very inconfiderable in a grown Body which ufes but little Exercife, provided the Body be fupported with a proper Quantity of good Food, and the Proportion of the Meat to the Drink be not lefs than

than that of 1 to 2. The Quantity of Food proper to preserve the Weight and Health of a grown Body, which uſes but little Exerciſe, much the ſame at all Seaſons of the Year, may be had from Table 1. p. 10.

*Obſ.* 3. Perſpiration and Urine are leſs affected by the Heat and Cold of the Air, and approach nearer to a Proportion of Equality in Summer and Winter, when the Quantity of the Food is leſs, and the Proportion of the Meat to the Drink greater, than when the Quantity of the Food is greater, and that Proportion is leſs. This appears from the Tables 1 and 2. In the Summer 1721, the daily Quantity of my Food at a Medium was 88.44 Ounces, and I judge the Proportion of my Meat to my Drink to have been about $\frac{3}{8}$, my Meat being about 24 Ounces in a Day, and my Drink 64.44. And in the Summer 1745, the daily Quantity of my Food at a Medium was 56.31 Ounces, and the Proportion of my Meat to my Drink was nearly $\frac{3}{5}$, my Meat being 21.33

Ounces in a Day, and my Drink 34.98. In the Summer 1721 Perspiration was greater than Urine, in the Proportion of 1340 to 1000; and in the Summer 1745 it was almost equal to Urine, only less in the Proportion of 967 to 1000. And therefore Perspiration and Urine approach nearer to a Proportion of Equality in Summer and Winter, under a lesser Quantity of Food, and a greater Proportion of the Meat to the Drink, than they do under a greater Quantity of Food, and a less Proportion of the Meat to the Drink.

Hence we may conclude, that *Cornaro*'s Perspiration and Urine were equal at all Seasons of the Year; for he did not take above half my Quantity of Food, and his Meat to his Drink was almost double of my Meat to my Drink, his being $\frac{6}{7}$, and mine about $\frac{1}{2}$; for $\frac{6}{7}$ is to $\frac{1}{2}$, as 12 to 7. By this small Quantity of Food, and great Proportion of his Meat to his Drink, this noble *Venetian* at the Age of forty, freed himself, by the Advice of his Physicians, from several grievous Disorders contracted

by

by Intemperance, and lived in Health of Body and great Chearfulneſs of Mind to above an Hundred. And I at the Age of ſixty-four, by leſſening my Food, and increaſing the Proportion of my Meat to my Drink, by leſſening my Drink about a third Part, and my Meat about a ſixth, of what they were in the Year 1721, have freed myſelf from the Returns of ſome ſlight Diſorders, and have greatly for my Age recovered the paralytick Weakneſs I was ſeized with about three Years ago. Hence we gather, that good and conſtant Health conſiſts in a juſt Quantity of Food, and a juſt Proportion of the Meat to the Drink; and that to be freed from chronical Diſorders contracted by Intemperance, the Quantity of Food ought to be leſſened, and the Proportion of the Meat to the Drink increaſed more or leſs according to the Greatneſs of the Diſorders; and that both the Quantity of Food, and the Proportion of the Meat to the Drink ought to be ſuch as ſhall make Perſpiration and Urine nearly equal at all Seaſons of the Year. For Changes of the Seaſons, as to

Heat

Heat and Cold, are the moſt common Cauſes of Diſeaſes; *Hipp. Aph.* 1. *Sect.* 3.

Before I proceed farther in the Obſervations, it is proper to give an Account of the Quality of my Food, and of the State of my Blood under this Reduction of my Food.

During the Year of Experiments from which I compoſed Table 2, I commonly eat four Ounces of Bread and Butter, and drank half a Pound of a very weak Infuſion of green Tea for Breakfaſt. For Dinner I took two Ounces of Bread, and the reſt Fleſh-meat, Beef, Mutton, Pork, Veal, Hare, Rabbet, Gooſe, Turkey, Fowl tame and wild, and Fiſh; and I generally choſe the ſtrongeſt Meats, as fitteſt, ſince they agreed well with my Stomach, to keep up the Powers of my Body under this great Diminution of my Food; I ſeldom took any Garden Stuff with my Meat, finding that it commonly leſſened Perſpiration, and increaſed my Weight. I drank four Ounces of Water with my Meat, and a Pound of Claret after I had done

done eating. And at Night I eat nothing but drank twelve Ounces of Water, with a Pipe of Tobacco. This was my Courſe of Diet during that Year. Ever ſince that Time, I have leſſened my Food a little; for in the following Year it was only 53 Ounces in a Day at a Medium; and this Year, as far as it is gone, which is ſeven Months, it is much about the ſame Quantity. This Diminution of my Food ſince the firſt Year, conſiſted chiefly in leſſening the Quantity of Water.

To know the State of my Blood under this Reduction of my Food, I had 1855 Grains of Blood drawn from my Arm the 28th of *May* 1747; which, after ſtanding twenty-four Hours, gave 1205 Grains of *Craſſamentum* or red part, and 650 Grains of *Serum*. Led R denote the Weight of the red part, and S the Weight of the *Serum*, and then $\frac{R}{S}$ will be $\frac{1205}{650}$ $= 1.854$. And the ſpecifick Gravity of the *Serum* was 10364, the ſpecifick Gravity of Water being 10000. The mean Proportion

Proportion of the red part of the Blood to the *Serum*, that is $\frac{R}{S}$, and the ſpecifick Gravity of the *Serum*, are, in the ordinary way of living, 1.400, and 10300 in healthful Men.

Notwithſtanding this great Proportion of the red part of my Blood to the *Serum*; it flowed out of the Orifice in a full Stream, and with great Force; which argues that it was very fluid whilſt it circulated in the Body. And that this greater than ordinary Proportion of the red part of my Blood to the *Serum*, has been of uſe to me now I uſe little Exerciſe, appears from my having been free two Years from a *ſore Throat* and a *Diarrhæa*, Diſorders I often had, though they were but ſlight and never confined me, when I lived more fully and uſed more Exerciſe; and it farther appears from my having had no Return of my convulſive and paralytick Diſorder.

Now, as the Proportion of the red part of my Blood to the *Serum*, has increaſed on

on increasing the Proportion of my Meat to my Drink, the Proportion of the red part of the *Serum* may in some sort be measured by the Proportion of the Meat to the Drink, that is, putting M for the Meat, and D for the Drink, $\frac{R}{S}$ may in some sort be measured by $\frac{M}{D}$. Hence, if the red part of the Blood bears too great a Proportion to the *Serum*, which is the Case of athletick Persons, and others who do not take a sufficient Quantity of Drink with their Meat, that Fault may be corrected, by lessening the Meat or by increasing the Drink. A young Man, who for a considerable Time had not drank with his Meat, and had a very florid Complexion and a scorbutick Eruption all over his Body, Arguments of too great a Proportion of the red part of the Blood to the *Serum*, was freed from the Eruption by drinking with his Meat, without any other Remedy. In the beginning of Fevers, the Proportion of the red part of the Blood to the *Serum* is greater, and at

the end of them lesser, than it is in Health; and the Change of this Proportion in Persons under these Disorders, is owing to their living wholly upon Drink and liquid Nourishment. And Bodies loaded with serous Moisture, an Argument of too small a Proportion of the red part of the Blood to the *Serum*, have been freed from their Load, by abstaining wholly from Drink.

But though the Proportion of the red part of the Blood to the *Serum*, varies with the Proportion of the Meat to the Drink, yet there are other Things, besides the bare Quantities of Meat and Drink, which have a Share in settling the Proportion of the red part of the Blood to the *Serum*. For this proportion is greater in Country People than Citizens, in Persons who use Exercise than in Persons who are inactive, and in Persons who live upon Flesh-meats and fermented Liquors, than in Persons who live upon Vegetables and Water. In short, this Proportion is increased by Things which dry the

the Body and ſtrengthen the Fibres, and leſſened by Things of a contrary Nature.

Too great a Proportion of the red part of the Blood to the *Serum*, renders Bodies ſubject to inflammatory Fevers on taking Cold. For when Blood is drawn, and ſuffered to ſtand in the Air till it is cold, its red parts coaleſce and form a *Coagulum*, leaving the *Serum* almoſt as fluid as Water. This ſhews that the red Corpuſcles of the Blood attract one another more ſtrongly, than they do the tranſparent Corpuſcles of the *Serum*; and conſequently, when the Blood happens to be greatly ſtock'd with red Corpuſcles, and they are brought ſtill nearer together by Cold, their attractive Forces may make them run together, coaleſce, and obſtruct the capillary Blood-veſſels, in which I have ſhewn the Motion of the Blood to be exceeding ſlow. And this they will be the moſt apt to do in the Blood-veſſels of thoſe parts which are moſt expoſed to the Cold of the Air, as the Blood-veſſels of the Throat, Lungs,

and *Pleura* are; whence arife Inflammations of thofe parts.

*Obf.* 4. The Quantity and Quality of the Food, and the Proportion of the Meat to the Drink, being given, the Weight of a Body is lefs, and confequently its Difcharges greater in dry Weather than in wet Weather. In the firft fifteen Days of *May*, when the Air was dry, the daily Quantities in Ounces of my Perfpiration and Urine, at a Medium, were 29.66 and 28.50; and in the nine following Days, when the Air was moift, the mean Quantities of Perfpiration and Urine in a Day were 20.39 and 28.94 Ounces. I took above four Ounces of Food more in a Day the firft fifteen Days, than I did the nine Days, and yet I gained two Pounds under the leffer Quantity of Food, and fhould have gained twice as much, had I not one Day leffened my Food above forty Ounces. Hence Perfpiration was 9.27 Ounces in a Day lefs, and Urine only the 0.44 part of an Ounce greater, in the

the nine wet Days, than in the fifteen dry Days; and consequently my Perspiration was above twenty times more lessened than my Urine was increased, by this Change of Weather from dry to wet. Hence Bodies, which live much in the same manner, as to the Quantity and Quality of their Food, and the Proportion of their Meat to their Drink, are lighter in dry Weather than in wet Weather, which may be thus accounted for. The Moisture of the Air moistens the Fibres of the Skin, and lessens Perspiration by lessening their vibrating Motion. For the moister the Fibres of the Skin are, the greater is their Density; and the greater their Density is, the less is the Density of the Æther lodged within them; and the less the Density of the Æther is, the weaker is its vibrating Motion; and the weaker the vibrating Motion of the Æther is, the weaker is the vibrating Motion of the Fibres caused by it. The vibrating Motion of the Air, Æther, and all elastick Fluids, is made less and slower by Water and watry Moisture. Hence mu-

sical

sical Sounds which are caused by a vibrating Motion in the Air, are lower and graver in a moist Atmosphere than in a dry one. The Sound of a musical Catgut String is made weaker and graver by wetting the String. And the Case is the same in the Nerves and Fibres of the Skin, watry Moisture apply'd to them lessens their vibrating Motions, and of consequence lessens Perspiration depending on those Motions. And when Perspiration is thus lessened by the Moisture of the Air, Urine by degrees is increased, but not equally, as appears by the above Instance; whence a Body from a given Quantity of Food, and a given Proportion of the Meat to the Drink, is necessarily heavier in wet Weather than in dry Weather.

Hence we learn, that to keep a Body of the same Weight in wet Weather as in dry, either the Quantity of Food must be lessened, or the Proportion of the Meat to the Drink increased; and both these will

will be done by leſſening the Drink, without making any Change in the Meat.

By comparing this Obſervation with the two firſt Obſervations, it appears, that the Heat and Dryneſs of the Air change the Weight of the Body in like manner, for they both leſſen it; and that the Cold and Moiſtneſs of the Air likewiſe change the Weight in the ſame manner, for they both increaſe it.

*Obſ.* 5. By the firſt part of Table 3, when I lived more fully and uſed more Exerciſe, both Perſpiration and Urine drawn off hourly from the Blood during the whole eight Months, were at a Medium greater in the Day than in the Night; Urine was greater almoſt in the Proportion of 3 to 2, and Perſpiration greater in the Proportion of 5 to 4. And by the ſecond part of the Table, when the Quantity of my Food was conſiderably leſs, and the Proportion of my Meat to my Drink greater, the Quantity of Urine drawn off from the Blood hourly

at a Medium throughout the whole Year, was nearly the ſame in the Day and in the Night, in the Time of my being up and Time of my being in Bed, only it was ſomething greater in the Night than in the Day; and the hourly Perſpiration was remarkably greater in the Day than in the Night, in the Proportion of 1298 to 896. The Cauſe of the remarkable Inequality between the Quantities of Urine drawn off hourly from the Blood in the Day and in the Night in the firſt part of the Table, was too great a Quantity of Drink taken at Dinner. For when above a certain Quantity of Drink is taken with the Meat at Dinner, it is apt to run off quick by Urine, and ſo to make the Day's Urine exceed the Night's Urine more than if leſs Drink had been taken.

Now as Bodies are apt to be diſordered by ſuch a Quantity of fermented Liquors as paſſes off quick in pale Urine, it is rational to think that the Quantity of Drink ought not to exceed ſuch a Quantity as can be drawn off from the Blood at much the

ſame

ſame rate in the Day and in the Night; which Quantity may be known by *Table* 1. p. 10. ſuppoſing the Drink to the Meat to be as 2 to 1, and the Body to be grown, and to uſe but little Exerciſe; for the Quantities of Food ſet down in that Table, and the Proportion of the Drink to the Meat, may not be ſufficient for growing Bodies, and Bodies which uſe much Exerciſe. And the Cauſe of the remarkable Inequality between the hourly Perſpiration in the Day and in the Night, was a Difference in the Heat and Motion of the Blood in thoſe two times. For the Heat and Motion of the Blood are always greater, from a greater Activity in the Soul, in the Day, than in the Night; and they are likewiſe ever greater from the Food taken in the Day-time; for the Pulſe is always quicker after eating than before it, after a full Meal than after a ſpare one, and after a Meal of drier and ſtronger Food than after a Meal of Food that is moiſter and weaker. My Food was remarkably dry and of a ſtrong Nature in the ſecond Table, when compared with what it was in the firſt. And

therefore the remarkable Inequality between the mean hourly Perſpiration in the Day and Night might be cauſed by a Difference in the Motion of the Blood in thoſe Times.

*Obſ.* 6. The mean hourly Perſpiration in the Day exceeds the mean hourly Perſpiration in the Night, in both parts of Table 3. And the Proportion of the mean hourly Perſpiration in the Day to the mean hourly Perſpiration in the Night, is greater in the ſecond part of that Table than in the firſt, when the Food was leſs in Quantity and drier, than when it was more in Quantity and moiſter. In Summer and Autumn, the mean hourly Perſpiration in the Day in Proportion to the mean hourly Perſpiration in the Night, was 1.581 and 1.602 in the ſecond part of the Table, when the Food was leſs and drier; and 1.302 and 1.292 in the firſt part of the Table, when the Food was more and moiſter. To make theſe Things more evident, I compoſed the following Tables from Table 3 and Table 7. Theſe Tables, in the Columns $\frac{du}{nu}$, $\frac{dp}{np}$, exhibit the mean

mean Quantities of Urine and Perſpiration drawn off hourly from the Blood in the Day, in Proportion to their mean Quantities drawn off hourly in the Night; and in the Columns $\frac{dp}{du}$, $\frac{np}{nu}$, exhibit the mean hourly Quantity of Perſpiration in Proportion to the mean hourly Quantity of Urine, drawn off from the Blood in the Day and in the Night, in the ſeveral Seaſons of the Year.

TABLE 11. taken from TABLE 3.

| Seaſons. | A. D. 1721. $\frac{du}{nu}$ | $\frac{dp}{np}$ | $\frac{dp}{du}$ | $\frac{np}{nu}$ | A. D. 1744-5. $\frac{du}{nu}$ | $\frac{dp}{np}$ | $\frac{dp}{du}$ | $\frac{np}{nu}$ |
|---|---|---|---|---|---|---|---|---|
| Winter | | | | | 0.876 | 1.348 | 1.059 | 0.688 |
| Spring | | | | | 0.811 | 1.299 | 1.192 | 0.744 |
| Summer | 1.427 | 1.302 | 1.289 | 1.413 | 1.175 | 1.581 | 1.063 | 0.790 |
| Autumn | 1.315 | 1.292 | 1.277 | 1.299 | 1.002 | 1.602 | 1.241 | 0.776 |
| Mean | 1.371 | 1.297 | 1.283 | 1.356 | 0.966 | 1.457 | 1.139 | 0.749 |

TABLE 12. taken from TABLE 7.

| Seaſons. | $\frac{du}{nu}$ | $\frac{dp}{np}$ | $\frac{dp}{du}$ | $\frac{np}{nu}$ |
|---|---|---|---|---|
| Spring | 1.341 | 1.697 | 0.738 | 0.583 |
| Summer | 0.947 | 1.533 | 1.202 | 0.742 |
| Autumn | 1.165 | 1.412 | 0.967 | 0.798 |
| Winter | 1.402 | 1.567 | 0.805 | 0.721 |
| Mean | 1.214 | 1.552 | 0.928 | 0.711 |

From the second part of Table 11, in which the Food was less in Quantity and drier, Perspiration exceeded Urine in the Day, and fell short of it in the Night, at all Seasons of the Year; whereas in the first part of this Table, where the Food was more in Quantity and moister, Perspiration exceeded Urine both Day and Night, in Summer and Autumn. From the second part of Table 11 it appears, that Perspiration and Urine are so contrived by the great Author of Nature, that when one increases the other lessens, both in different parts of the natural Day, and in different Seasons of the Year; by which wise Contrivance, grown Bodies, which do not use much Exercise, and take a proper Quantity of good Food, and rightly proportion the Meat to the Drink, will be little affected with the sensible Qualities of the Air, and will continue of the same Weight, and in good Health, at all Seasons. Other Persons who live irregularly as to Diet, will scarcely be able, as appears from what is said in these Obser-

vations,

vations, to paſs the four Seaſons without Diſorders.

*Obſ.* 7. In this Obſervation I ſhall ſhew how Perſpiration and Urine are affected by the Paſſions of the Mind. Anger and Joy increaſe, and Fear and Sadneſs leſſen, both Perſpiration and Urine. The Soul, which has great power over the Body by virtue of the Æther, when it is made uneaſy by the Paſſion of Anger, raiſes a ſtrong vibrating Motion in the Æther within its *Senſorium*, which Motion is propagated through the Nerves to all parts of the Body. This ſtrong Motion in the Membranes of the Heart quicken its Contraction and Dilatation, and thereby quicken the Contraction and Dilatation of the Blood-veſſels and ſecerning Ducts, and of conſequence increaſe the Diſcharges of Perſpiration and Urine, and that more or leſs in proportion to the Strength and Continuance of the Paſſion. I had one Inſtance of this in *November* 1744, in which both Urine and Perſpiration were increaſed

increased considerably by this Passion, in the Day and Night, from what they were the Day and Night before. Joy affects these Discharges in like manner as Anger. In the Passions of Fear and Sorrow, Perspiration and Urine are lessened, by a Diminution of the vibrating Motion of the Æther, occasioned by a Depression of the Power of the Will and Activity of the Soul, under those Passions. Hence Joy and Anger increase, and Fear and Sorrow lessen, Perspiration and Urine, and the Weight of the Body. And other Passions, as they partake of these, will affect the Discharges and Weight of the Body in like manner. That the Soul has an entire Power over the vibrating Motion of the Æther, may be gathered from its moving the Limbs with various Degrees of Velocity, and from its stopping and changing those Motions at pleasure; and likewise from that infinite Variety of musical Sounds caused by an infinite Variety of Vibrations in the Air and Æther, which can be produced by a fine Voice.

Conſidering the great Power the Soul has over the Body in cauſing and regulating its Motions by the Æther, it may be proper to explain the great Law by which the Soul acts in this high Station. The Soul, by its ſenſitive and intelligent Nature, knows and feels the Wants and Diſorders of the Body by the Senſations of Uneaſineſs and Pain, and perceives the Removal of thoſe Wants and Diſorders by the Senſations of Eaſe and Pleaſure. Now ſince all Uneaſineſs may be reckoned Pain, and all Eaſe Pleaſure, Pain and Pleaſure are the two great Senſations of the Soul, which cauſe it to excite ſuch Motions in the Æther of the Nerves, and thereby ſuch Motions in the ſeveral parts of the Body, as are fit to remove Pain and give Pleaſure. Hunger and Thirſt are the painful Senſations whereby the Soul is put upon raiſing ſuch Motions in the Body as are neceſſary to procure Meat and Drink. And ſtretching the Stomach by too full a Meal creates a painful Senſation, whereby the Soul is urged to raiſe ſuch

fuch Motions in the Body as are neceffary to free it from the Load; accordingly, if the Load arife from too much Drink, it often hurries it out of the Body in pale Urine, but if it arife from too much Meat, it commonly throws it off by Stool or Sweat, oftener by Stool in weak Bodies, and by Sweat in ftrong Bodies.

*Obf.* 8. The Proportion of Perfpiration to Urine is increafed by all thofe Exercifes which increafe the Motion of the Blood, and warm the Skin; as is proved by Experiments in the *Animal Oeconomy*, p. 280.

*Obf.* 9. In *January* and *February* of Table 2, the daily Difcharge by Stool at a Medium, was greater than in any of the other Months; which was owing to a *Diarrhœa* which began the 30th of *January*, and continued four Days to the 3d of *February*. During this Difcharge, which at a Medium was above two Pounds a Day, Perfpiration and Urine were both leffened, and with refpect to their

their Quantities before this Diſcharge began, the Decreaſe of Urine was above double that of Perſpiration. For before the *Diarrhœa* began, the daily Quantities of Perſpiration and Urine were 27 and 30, and for the four Days of the Diſcharge they were at a Medium 25 and 24 nearly. The Decreaſe of Urine during the *Diarrhœa* was 6 Ounces a Day, and the Decreaſe of Perſpiration 2; but $\frac{6}{30}$ is to $\frac{2}{27}$ as 162 to 60, that is as 2.7 to 1. The Matter of a *Diarrhœa* is ſupply'd by Blood-veſſels, which are nearer to the Blood-veſſels of the Kidneys than they are to the Blood-veſſels of the Skin. On which account, when the Diſcharge by Stool is much increaſed by a *Diarrhœa*, both Perſpiration and Urine are leſſened, and Urine, from its being a nearer Diſcharge as being ſupply'd by nearer Blood-veſſels, is leſſened more than Perſpiration. And when a *Diarrhœa* ſtops, Urine by the Stoppage of that Diſcharge is more increaſed than Perſpiration. All this neceſſarily happens from the Nature and Laws of the Blood's Motion. The Truth

of this appears, when a *Diarrhœa* or *Dysentery* is stopped by large Quantities of plain Water, Barley Water, Ptisan, or Chicken Water, drank warm; for as soon as the Pain abates, from the acrid Salts being diluted and carry'd off by Stool, the Water turns to the Kidneys and passes off quick by Urine like Spa-water, which soon puts a Stop to the Discharge by Stool. One thing I must observe concerning the Discharge by Stool, that since I lessened my Drink, I have been much more costive than I was before. Costiveness generally attends dry Food in other Animals as well as Men.

*Obs.* 10. During the Course of Experiments from which I formed Table 2, the Morning Weight of my Body was continually changing, either increasing or decreasing. Sometimes it increased or decreased for some Mornings together, but then the whole Increase or Diminution never amounted to above 63 Ounces. In the beginning of *February* I gained 41 Ounces in six Days, having lost by a *Diarrhœa*

*arrhœa* 63 Ounces in three Days before. Table 6 ſhews ſome of the moſt remarkable Changes of Weight, whether Increaſe or Diminution, which happened to me that Year, together with the Months, Days, and Quantities of Food taken on thoſe Days, in which the Changes happened. The Increaſe and Diminution of my Weight was commonly cauſed by an Increaſe and Diminution of my Food; tho' I have known my Weight increaſed by Fruit and Garden Stuff; when the whole Quantity of what was taken, was leſs than my ordinary Quantity of Food; which was the Caſe on the 30th of *June*.

If the Increaſe of Weight in a ſmall Compaſs of Time, riſe to above a certain Quantity, it will be apt to cauſe Diſorders. I can bear an Increaſe of above a Pound and a half in one Day, and an Increaſe of three or four Pounds in ſix or ſeven Days, without being diſordered; but am apt to think that I ſhould ſuffer from an Increaſe of five or ſix Pounds in that Time. An Increaſe of Weight may

be carry'd off by leffening the Food, or by increafing the Difcharges; and the Difcharges may be increafed either by Exercife, or by Evacuations procured by Art. By leffening the daily Quantity of my Food to 23 Ounces, I have loft 26 Ounces; by fafting a whole Day laft Month, I loft 48 Ounces, having gained 27 the Day before; and by fafting a whole Day this Month I have loft 42 Ounces, having gained 7 Ounces the Day before. I am not able to ufe much Exercife at prefent, but have fhewn from Experiments in the *Animal Oeconomy* how much a Body may lofe by Exercife. Mr. *Rye*, who was a ftrong well-fet corpulent Man of a fanguin Complexion, by a brifk Walk for one Hour before Breakfaft, threw off by infenfible Perfpiration one Pound of increafed Weight; and by a Walk of three Hours, he threw off two Pounds of increafed Weight. I have loft by a fpontaneous *Diarrhœa* two Pounds in twenty-four Hours; and Mr. *Rye* loft twice that Quantity in the fame Time. A ftrong purging Medicine may leffen the

Weight

Weight of a grown Body about two or three Pounds, as I have ſhewn in the *Animal Oeconomy*. The beſt way to take off an Increaſe of Weight which threatens a Diſtemper, is either by Faſting or Exerciſe. But nothing, amidſt a Variety of diſturbing Cauſes, will be able ſo effectually to prevent ſuch an Increaſe of Weight as ſhall cauſe a Diſtemper, as a very exact and regular Diet which can keep the Body of a right Weight, and prevent the Diſcharges from running into Irregularities, and Diſproportions to one another.

*Obſ.* 11. The ſpecifick Gravity of my Urine in Table 2, was greater in the Night than in the Day, when I was in Bed than when I was up. Hence we learn, that Urine draws off more Contents from the Blood in Sleep than when Bodies are awake; and conſequently, that natural Sleep is a very good Sign in Fevers, in which the Blood abounds more with Contents than it does in Health.

*Obs.* 12. According to Dr. *Lining*, the sickly Months in *Charles-town* at *South Carolina*, are *July*, *August*, and *September*. The Heat of the Air in each of those Months, is greater than its Heat in any other Month except *June*, as may be seen in Table 9; and the mean Heat in those three Months, is greater than the Meridian Heat of the Air in *England* in the Month of *July*, which by *Newton*'s Scale is 6, in the proportion of 8.63 to 6, or 863 to 600. And the mean Quantities of Rain, and Moisture in the Air, are each of them greater in those three Months than in the three preceding Months. Hence it seems very reasonable to conclude, that the Sickliness at that Season is caused by the Heat, and Moisture of the Air; for Bodies are more disposed to Putrefaction in a hot and moist Air, than in a cold and dry Air. Perhaps it may be asked, Since the Air in *South Carolina* is much hotter than it is in *England* and *Ireland*, and even in *Italy*, where

it

it is much hotter than in theſe Countries, why *Lining*'s yearly Perſpiration fell ſhort of his yearly Urine, taking one Month of the whole Year with another, when in *Sanctorius* and *Rye* Perſpiration exceeded Urine at all Seaſons of the Year? To this may be anſwered, That though the Air is hotter in *South Carolina* than in the Countries I have mentioned, and on that account draws the Moiſture of the Body more to the Skin, and increaſes Perſpiration; yet both the Quantity and diuretick Quality of the Drink are much greater in *South Carolina* than in the aforeſaid Countries, which may make it to paſs off in a greater Quantity by Urine than by Perſpiration; for a large Quantity of Drink of a diuretick Nature commonly paſſes off very quick by Urine. The Drink commonly uſed in Summer in *Charles-town* is a weak Punch thus made: Take of Water 2 Troy Pounds, of Sugar 1½ Ounce, of recent Lime-juice 2½ Ounces, of Rum 3½. M. That which is uſed in Autumn and Winter is richer, having more Sugar and Rum, and leſs Acid. And if the Moiſture

Moisture of the Air be greater there than in these Countries and in *Italy*, that may likewise contribute to lessen Perspiration and promote Urine, by *Obs.* 4. *Keill's* Urine exceeded his Perspiration in all Months of the Year except *August*, in which Month Perspiration was nearly equal to Urine, only a little larger, as appears from Table 7. He often drank Punch, and was much on Horseback; both of which promote Urine much more than they do Perspiration, as appears by common Experience. Whether any other Cause contributed to produce this Effect in Dr. *Keill's* Discharges I cannot tell, not having known him, and being wholly unacquainted with his Constitution. One Thing indeed, besides those already mentioned, I am satisfied, is much concerned in fixing the Proportion of Perspiration to Urine, and that is, the Force of the Heart in Proportion to the attractive Power of the Kidneys. For a weaker Heart, or Kidneys stronger either naturally or by Irritation, may lessen the Proportion

of

of Perſpiration to Urine, and on the contrary.

*Obſ.* 13. The Sum of Perſpiration and Urine drawn off hourly from the Blood, is greater in the Day than in the Night, in the Time of being up than in the Time of being in Bed, as appears from Table 3, and the Tables of *Keill* and *Lining*. Hence, when the Food is the ſame, as to Quantity, Quality, and the Proportion of the Meat to the Drink, and the Exerciſe likewiſe the ſame; thoſe Bodies will be apt to gain moſt in their Weights which get moſt Sleep; which agrees with Experience. For much Sleep, much Food, and little Exerciſe, are the principal Things which increaſe the Weight of the Body, and make Animals grow fat. Conſequently, if the Weight of the Body be too great for good and uninterrupted Health, it may be leſſened by leſſening the Sleep and Food, and by increaſing the Exerciſe. And if the Body, on account of Age or other Infirmities, cannot uſe any Exerciſe of Conſequence, and takes

much the fame Quantity of Sleep, its Weight muft be leffened by leffening its Food, which may be done by leffening the Drink, without making any Change in the Meat; as I have found by Experience in myfelf. For my Exercife now being very inconfiderable, and of little Confequence with regard to the Change of my Weight, and the Quantity of found Sleep, being now fix or feven Hours, which is much the fame as formerly; the Diminution of my Weight ought wholly to be attributed to the Diminution of my Food, which confifted chiefly in leffening the Quantity of my Drink. I go to Bed early, and rife early, and have done fo the greateft part of my Life. On the contrary, if the Weight of the Body be too little for good and uninterrupted Health, it may be increafed by increafing the Food and Sleep, and by leffening the Exercife; and the Food muft be increafed chiefly by increafing the Drink and liquid Nourifhment. For the Difcharges are ordinarily lefs from Drink and a liquid Nou-

rifhment,

rifhment, than from dry and folid Food; as I have fhewn above.

*Obf.* 14. By Table 9, Dr. *Lining*'s Weight was confiderably lefs in hot Weather than in cold. He fell away in *April*, *May*, *June*, *July*, *Auguft* and *September*, and loft in thofe fix Months above fifteen Averdupois Pounds, which he gained again and near a Pound and a half more, in *October*, *November*, *December*, and *January*. It is to be obferved that the fickly Months in that hot Climate, were fome of thofe in which he fell away. See *Sanct. Aph.* 54, 55, 56. *Sect.* 2.

*Obf.* 15. There is but one Weight under which a grown Body can enjoy the beft and moft uninterrupted Health; and that Weight muft be fuch, that Perfpiration and Urine may be nearly equal at all Seafons of the Year; for by this Means the Body will be uniformly drain'd of its Moifture, the inward Parts by Urine, and the more fuperficial Parts by Perfpiration, without any irregular and unnatural Dif-

charges, and its Morning Weight will continue nearly the ſame at all Seaſons of the Year. This Weight may be ſettled by the preceding Obſervations.

*Obſ.* 15. " In the Winter, when the
" Perſpiration of an unexerciſed Perſon is
" only equal to the Urine, the Diet for
" twenty-four Hours ought not to exceed
" four Pounds or four Pounds and a half.
" In Summer the Diet may be ſix Pounds
" and a half, which may be carry'd off
" without the Help of Exerciſe when
" the Air is hot and dry. *Rye Aph.* 25,
" 26. If the Meat and Drink of one
" Day be four Pounds and a half, the
" Perſpiration of that Day will be two
" Pounds, the Urine two Pounds and
" five Ounces, and the Stool three Ounces.
" From about four Pounds of Food the
" Body daily returns to the ſame Weight;
" but from a leſſer Quantity of Food the
" Weight of the Body leſſens, and from
" a greater Quantity it increaſes." *Keillei Obſ. unius anni*, *p.* 17. By comparing theſe Aphoriſms and Obſervations with what

what I ſaid above concerning my own Food, we may allow the Quantity of Food that is neceſſary to preſerve a grown Perſon, who uſes but little Exerciſe, conſtantly in good Health, to be pretty rightly determined in the Column F of Table 1. p. 10. For that Quantity of good Food will keep the Diſcharges of Perſpiration and Urine equal, and the Morning Weight of the Body the ſame at all Seaſons of the Year. Hence we may judge of the healthful Quantity of Food; for if the Quantity of Food be ſuch as to make the Perſpiration and Urine of a natural Day always nearly equal, and the Morning Weight of the Body always nearly the ſame, that Quantity is the truly healthful Quantity of Food for grown Bodies, who uſe but little Exerciſe.

*Obſ.* 16. The Quantity of Food neceſſary to keep a grown Body in Health, will be better and more eaſily digeſted when it is ſo divided as to make the Meals equal, than when it is ſo divided as to make them very unequal. For inſtance; if three

three Pounds of Food is to be taken in a Day at three Meals, it will be better to take a Pound at each Meal, than to take two Pounds at one Meal, and half a Pound at each of the other two; and if the fame Quantity of Food is to be taken at two Meals, it will be better to take a Pound and a half at each Meal, than to take two Pounds at one Meal, and one Pound at the other. And as to the Diftance between one Meal and another, it ought ever to bear fome Proportion to the Largenefs of the preceding Meal; for inftance, if three Meals be taken in a Day, they may be taken at the Diftance of eight Hours from each other, and at the diftance of twelve Hours if only two Meals be taken in a Day. But though the Food be equally divided between the Meals, yet there ought to be fome Difference in the Diftances between them; for Perfpiration and Urine being drawn off from the Blood more flowly in the Night than in the Day, the Diftance between Supper and Breakfaft next Morning, ought to be greater than the Diftance between Breakfaft and Dinner,

Dinner, or between Dinner and Supper. N. B. Perſons who are ſubject to Diſorders of the Head, ought not to take any Food at Night.

If the Quantity of Food be given, its Quality will cauſe a Difference in the Time of digeſting; for inſtance, ſlimy and viſcid Meats are longer in digeſting in the Stomach than Meats of a contrary Nature; the Fleſh of ſome young Animals is not ſo ſoon digeſted as the Fleſh of the ſame Animals arrived at their full Growth; thus Veal and Lamb are not ſo ſoon digeſted as Beef and Mutton. A Man who took a Vomit every ſecond Night for ſome Months, obſerved, that when he had taken Chicken for Dinner, he always threw it up undigeſted, but never threw up any of his Food undigeſted when he had made his Dinner on Beef or Mutton.

I now proceed to illuſtrate what has been ſaid, by Obſervations drawn from Experiments made on other Animals.

OBSER-

## OBSERVATIONS *drawn from Experiments made on other Animals.*

THE following Tables exhibit the mean Weights of the Bodies, Hearts and Livers, of ſeveral Species of Birds and Fiſhes whoſe Names are ſet down in the firſt Column. The mean Weights of the Bodies, Hearts and Livers, in Grains, are ſet down in the Columns W, H and L; and the Proportion of the Heart and Liver to the Weight of the Body, and of the Liver to the Weight of the Heart, are ſet down in the Columns $\frac{H}{W}$, $\frac{L}{W}$ and $\frac{L}{H}$. Many of the Numbers are Means taken from ten Experiments, as were moſt of the Numbers of the Fiſhes; but ſome of the Numbers of the Birds were Means taken from a leſſer Number of Experiments. The Heart was cleared from all Appendages of Fat and large Veſſels, and was only the bare Muſcle of the Heart; the Liver was without the Gall-Bladder; and in Birds the Weight of the Body was its Weight without Feathers.

TABLES

## TABLE I.

| Wild Birds. | W | H | L | $\frac{H}{W}$ | $\frac{L}{W}$ | $\frac{L}{H}$ |
|---|---|---|---|---|---|---|
| Cock green Linnets | 352 | 5.9 | 7.9 | $\frac{1}{59}$ | $\frac{1}{44}$ | 1.34 |
| Hen green Linnets | 396 | 5.9 | 11.5 | $\frac{1}{67}$ | $\frac{1}{34}$ | 1.95 |
| Cock Sparrows | 427 | 6.3 | 19.5 | $\frac{1}{68}$ | $\frac{1}{22}$ | 3.10 |
| Hen Sparrows | 404 | 5.6 | 19.0 | $\frac{1}{72}$ | $\frac{1}{21}$ | 3.39 |
| Cock Teals | 7000 | 76.0 | 122.0 | $\frac{1}{92}$ | $\frac{1}{57}$ | 1.60 |
| Hen Teals | 5080 | 56.0 | 144.0 | $\frac{1}{91}$ | $\frac{1}{35}$ | 2 57 |
| Mallards | 16796 | 157.0 | 360.0 | $\frac{1}{107}$ | $\frac{1}{46}$ | 2.29 |
| Ducks | 15143 | 129.0 | 343.0 | $\frac{1}{117}$ | $\frac{1}{44}$ | 2.66 |
| Mean of the Male Wild Birds | 6144 | 61.3 | 127.3 | $\frac{1}{100}$ | $\frac{1}{48}$ | 2.08 |
| Mean of the Female Wild Birds | 5256 | 49.1 | 129.4 | $\frac{1}{107}$ | $\frac{1}{40}$ | 2.63 |
| Mean of the whole Wild Birds | 5700 | 55.2 | 128.3 | $\frac{1}{103}$ | $\frac{1}{44}$ | 2.32 |

## TABLE 2.

| Tame Birds. | W | H | L | $\frac{H}{W}$ | $\frac{L}{W}$ | $\frac{L}{H}$ |
|---|---|---|---|---|---|---|
| Cock Pigeons young | 3003 | 29 | 126 | $\frac{1}{103}$ | $\frac{1}{24}$ | 4·34 |
| Hen Pigeons young | 2908 | 27 | 128 | $\frac{1}{108}$ | $\frac{1}{23}$ | 4·74 |
| Cocks, game, $2\frac{1}{4}$ Years old | 25674 | 159 | 410 | $\frac{1}{161}$ | $\frac{1}{62}$ | 2.58 |
| Hen Chickens, game, 9 Weeks old | 6064 | 34 | 239 | $\frac{1}{178}$ | $\frac{1}{25}$ | 7.03 |
| Drakes | 17884 | 117 | 468 | $\frac{1}{153}$ | $\frac{1}{38}$ | 4.00 |
| Ducks | 16714 | 103 | 426 | $\frac{1}{162}$ | $\frac{1}{39}$ | 4.13 |
| Barn-door Cocks, old | 17504 | 84 | 360 | $\frac{1}{208}$ | $\frac{1}{49}$ | 4.28 |
| Barn-door Hens, old | 19315 | 63 | 508 | $\frac{1}{307}$ | $\frac{1}{38}$ | 8.06 |
| Barn-door Cocks, young | 21087 | 105 | 433 | $\frac{1}{201}$ | $\frac{1}{49}$ | 4·12 |
| Barn-door Hens, young | 21889 | 52 | 454 | $\frac{1}{421}$ | $\frac{1}{48}$ | 8.73 |
| Cock Chickens | 12380 | 47 | 412 | $\frac{1}{263}$ | $\frac{1}{30}$ | 8.77 |
| Hen Chickens | 10046 | 34 | 328 | $\frac{1}{295}$ | $\frac{1}{31}$ | 9.65 |
| Cram'd Cocks | 21065 | 92 | 673 | $\frac{1}{229}$ | $\frac{1}{31}$ | 7·31 |
| Cram'd Hens | 23990 | 60 | 1037 | $\frac{1}{400}$ | $\frac{1}{23}$ | 17·28 |
| Mean of the Male Tame Birds | 16942 | 90 | 412 | $\frac{1}{188}$ | $\frac{1}{41}$ | 4.58 |
| Mean of the Female Tame Birds | 14418 | 53 | 446 | $\frac{1}{272}$ | $\frac{1}{32}$ | 8.41 |
| Mean of the whole Tame Birds | 15680 | 72 | 429 | $\frac{1}{218}$ | $\frac{1}{36}$ | 5·96 |

## TABLE 3.

| Round Fish. | W | H | L | $\frac{H}{W}$ | $\frac{L}{W}$ | $\frac{L}{H}$ |
|---|---|---|---|---|---|---|
| Male Mackarels | 7054 | 10.4 | 125 | $\frac{1}{678}$ | $\frac{1}{56}$ | 12.0 |
| Female Mackarels | 7579 | 11.2 | 223 | $\frac{1}{677}$ | $\frac{1}{34}$ | 19.9 |
| Male Salmon Trouts | 8925 | 11.4 | 164 | $\frac{1}{783}$ | $\frac{1}{54}$ | 14.4 |
| Female Salmon Trouts | 9074 | 10 6 | 131 | $\frac{1}{856}$ | $\frac{1}{69}$ | 12.3 |
| Male Salmons | 54614 | 62.5 | 795 | $\frac{1}{873}$ | $\frac{1}{69}$ | 12.7 |
| Female Salmons | 72095 | 70.4 | 1046 | $\frac{1}{1024}$ | $\frac{1}{67}$ | 14.8 |
| Male Herrings | 2489 | 2.2 | 11.2 | $\frac{1}{1131}$ | $\frac{1}{222}$ | 5.1 |
| Female Herrings | 2298 | 2 2 | 34 6 | $\frac{1}{1045}$ | $\frac{1}{66}$ | 15.7 |
| Male River Trouts | 4150 | 3.7 | 57 | $\frac{1}{1122}$ | $\frac{1}{73}$ | 15.4 |
| Female River Trouts | 3847 | 3.1 | 62 | $\frac{1}{1241}$ | $\frac{1}{62}$ | 20.0 |
| Male Cods | 90871 | 67 0 | 2070 | $\frac{1}{1356}$ | $\frac{1}{44}$ | 30.9 |
| Female Cods | 112044 | 84 7 | 3465 | $\frac{1}{1323}$ | $\frac{1}{32}$ | 40.9 |
| Male Whitings | 3281 | 2 3 | 102 | $\frac{1}{1426}$ | $\frac{1}{32}$ | 44.3 |
| Female Whitings | 3661 | 2 4 | 82 | $\frac{1}{1525}$ | $\frac{1}{44}$ | 34.2 |
| Mean of the Male Round Fish | 24483 | 22.8 | 475 | $\frac{1}{1074}$ | $\frac{1}{52}$ | 20.8 |
| Mean of the Female Round Fish | 30085 | 26.4 | 720 | $\frac{1}{1139}$ | $\frac{1}{42}$ | 27.3 |
| Mean of the whole Round Fish | 27284 | 24.6 | 598 | $\frac{1}{1109}$ | $\frac{1}{46}$ | 24.3 |

## TABLE 4.

| Flat Fish. | W | H | L | $\frac{H}{W}$ | $\frac{L}{W}$ | $\frac{L}{H}$ |
|---|---|---|---|---|---|---|
| Male Turbuts | 26090 | 12.00 | 311 | $\frac{1}{2174}$ | $\frac{1}{84}$ | 25.9 |
| Female Turbuts | 36400 | 15.26 | 460 | $\frac{1}{2385}$ | $\frac{1}{79}$ | 30.1 |
| Male Brets | 10157 | 4.37 | 132 | $\frac{1}{2324}$ | $\frac{1}{77}$ | 30.2 |
| Female Brets | 14745 | 5.80 | 110 | $\frac{1}{2542}$ | $\frac{1}{134}$ | 19.0 |
| Male Plaices | 16505 | 6.25 | 232 | $\frac{1}{2641}$ | $\frac{1}{71}$ | 37.1 |
| Female Plaices | 20979 | 9.14 | 276 | $\frac{1}{2295}$ | $\frac{1}{76}$ | 30.2 |
| Male Flounders | 2178 | 0.93 | 33 | $\frac{1}{2342}$ | $\frac{1}{66}$ | 35.5 |
| Female Flounders | 4396 | 2.08 | 122 | $\frac{1}{2113}$ | $\frac{1}{36}$ | 58.6 |
| Male Soles | 6557 | 2.59 | 51 | $\frac{1}{2532}$ | $\frac{1}{129}$ | 19.7 |
| Female Soles | 6887 | 2.79 | 58 | $\frac{1}{2468}$ | $\frac{1}{119}$ | 20.8 |
| Mean of the Male Flat Fish | 12297 | 5.25 | 152 | $\frac{1}{2351}$ | $\frac{1}{81}$ | 29.0 |
| Mean of the Female Flat Fish | 16681 | 7.01 | 205 | $\frac{1}{2380}$ | $\frac{1}{81}$ | 29.2 |
| Mean of the whole Flat Fish | 14489 | 6.12 | 178 | $\frac{1}{2367}$ | $\frac{1}{81}$ | 29.1 |

## OBSERVATIONS *on the Tables of Animals.*

*Obs.* 1. THE Weight of the Heart in proportion to the Weight of the Body, is greater in wild Birds than in tame Birds. The former uſe more Exerciſe, or move their Muſcles more, than the latter; and from the different Quantities of Motion in the Muſcles of wild Birds and tame, we may ſee the Reaſon why the Weight of the Heart in proportion to the Weight of the Body, is greater in the former than in the latter. When a Muſcle moves, it contracts and dilates alternately, in like manner as the Heart. In its Contraction it empties itſelf, as the Heart does in its Syſtole, preſſing the Blood forward towards the Heart with greater or leſſer Force, in proportion to the Strength of the Contraction. And in its Dilatation the Muſcle fills again, as the Heart does in its Diaſtole, with Blood ſent into it by the Force of the Heart.

Now

Now if many and large Muſcles be moved, it is evident that much more Blood will flow to the Heart during the Time of their Motion, than did before in an equal Time when the Muſcles were at Reſt. And the Heart, to prevent an Oppreſſion from an Overload of Blood, is made to quicken its Motion in order to ſend back the Blood as faſt as it is thrown upon it by the Motion of the Muſcles. Hence the Motions of the Heart and Blood are much increaſed by much Motion of the Muſcles. On the contrary, when the Quantity of Motion in the muſcular Syſtem is greatly diminiſhed by the Inactivity of Bodies, the Force of the Heart and Motion of the Blood will likewiſe be diminiſhed in the ſame Proportion. But Muſcles which are much moved always increaſe in Magnitude, Weight and Strength; and yet Bodies which uſe much muſcular Motion, are ſeldom obſerved to grow fat or increaſe in Weight. And therefore the Weight of the Heart in proportion to the Weight of the Body will be greater in wild Animals than in tame, in

Bodies

Bodies which uſe much Exerciſe than in Bodies which are inactive.

Hence Animals which uſe much Exerciſe have a greater Appetite and require more Food than Animals which are inactive. For the Appetite is proportional to the Sum of the Diſcharges, and the Sum of the Diſcharges is proportional to the Motion of the Blood, by *Prop*. 2. Which Motion being greater in Animals which uſe much Exerciſe than in Animals which are inactive, the Appetite to Food will of Conſequence be ſo too.

*Obſ.* 2. The Weight of the Heart in proportion to the Weight of the Body, is greater in ſmall Birds than in large ones, it is greater in a Sparrow than in a Gooſe. It is likewiſe greater in a Mouſe than in an Ox, in a Child than in a Man, and probably greater in little Men than in large Men. This Proportion expreſſed by $\frac{H}{W}$, in a ſtrong healthful Man, in a ſtrong Child newly born, in an Ox, in a Hare, and

and in a Mouſe, has been found by Experiment to be equal to $\frac{1}{240}$, $\frac{1}{160}$, $\frac{1}{240}$, $\frac{1}{110}$, and $\frac{1}{167}$. Now ſince ſmall Animals are generally more ſprightly and active than great Animals, we may allow the Sprightlineſs and Activity of a Body to depend much upon the Proportion of the Weight of the Heart to the Weight of the Body.

*Obſ.* 3. The Proportion of the Weight of the Heart to the Weight of the Body is leſs in fat Bodies than in lean. It is leſs in tame Birds than in wild Birds, and in cram'd Fowl than in Barn-door Fowl; and tame Birds are commonly fatter than wild Birds, and cram'd Fowl fatter than Barn-door Fowl. Butchers obſerve the ſame of Beaſts, that the fatter a Beaſt is, the leſs is its Heart. Now as Animals grow fat, the Weights of their Bodies increaſe, and their Quantities of Blood and Weights of their Hearts leſſen; for the Fat in the Membranes compreſſes the Blood-veſſels and leſſens the Quantity of Blood; and as that leſſens, the Weight of the

the Heart lessens, the Weight of the Heart and Quantity of Blood always decreasing and increasing together. And therefore, the Weight of the Heart in proportion to the Weight of the Body is less in fat Bodies than in lean Bodies. The Motion of the Blood, as well as its Quantity, is less in fat Bodies than in lean, by *Cor.* 3. *Prop.* 12. *Anim. Oecon.* And hence we may account for fat Bodies having a lesser Appetite than Bodies which are lean; for the Appetite is regulated by the Sum of the Discharges, and the Sum of the Discharges is regulated by the Motion of the Blood, which Motion being less in fat Bodies than in lean, the Appetite will of consequence be so too.

*Obs.* 4. The Weight of the Heart in proportion to the Weight of the Body, is greater in the Males than in the Females of Birds both wild and tame; and the Difference of this Proportion in the Males and Females of wild Birds, is less than its Difference in the Males and Females of tame Birds. This Proportion in the Males

and Females of wild Birds, is $\frac{1}{100}$ and $\frac{1}{107}$ in Table 1; and in the Males and Females of tame Birds, it is $\frac{1}{188}$ and $\frac{1}{272}$ in Table 2. But $\frac{1}{100}$ is greater than $\frac{1}{107}$, and $\frac{1}{188}$ is greater than $\frac{1}{272}$; and the Difference between $\frac{1}{100}$ and $\frac{1}{107}$ is considerably less than the Difference between $\frac{1}{188}$ and $\frac{1}{272}$. Now by *Obs.* 1, the Weight of the Heart in proportion to the Weight of the Body is increased by Exercise. But the Males of Birds, from their greater Activity and Strength, use more Exercise than the Females. And therefore the Weight of the Heart in proportion to the Weight of the Body, is universally greater in male Birds than in Female Birds, both wild and tame. This Proportion differs less in the Males and Females of wild Birds, than it does in the Males and Females of tame Birds: For the Males and Females of wild Birds probably exercise much alike, and are nearly equal in Fatness; but the Males and Females* of tame Birds differ more both in their Exercise and Fatness; for the Males exercise more, and are markably less fat than the Females, as appears

appears from Obſervation. And therefore the Difference of this Proportion is leſs in the Males and Females of wild Birds, than in the Males and Females of Birds which are tame.

What has been ſaid concerning this Proportion in the Males and Females of wild and tame Birds, holds equally true in the Males and Females of wild and tame Beaſts.

*Obſ.* 5. The Weight of the Heart in proportion to the Weight of the Body is much greater in Birds than in Fiſh. This Proportion at a Medium in the whole of wild and tame Birds, is $\frac{1}{168}$ by Tables 1, 2; and in the whole of round and flat Fiſh, it is $\frac{1}{1360}$ nearly, by Tables 3, 4. Conſequently, this Proportion is greater in the whole of the Birds, than in the whole of the Fiſh, in the Proportion of above 8 to 1. This great Difference in the Proportion of the Weight of the Heart to the Weight of the Body in Birds and Fiſh, is owing to the great Difference

of the Heat of the Blood in these two kinds of Animals, the Heat of the Blood being much greater in the former than in the latter. For a greater Degree of Heat in the Blood, will swell and enlarge the Capacity of the System of Blood-vessels, and make it bear a greater Proportion to the Weight of the Body than a lesser Degree of Heat. But the Force of the Heart in Animals is ever proportional to the Capacity of the System of Blood-vessels. And therefore the Force of the Heart with respect to the Weight of the Body will be greater in Birds than in Fish; that is, putting Æ for the Strength of the vibrating Motion of the Æther in the Heart, $\frac{\text{Æ H}}{\text{W}}$ will be greater in Birds than in Fish; by *Cor.* 5. *Prop.* 8. *Anim. Oecon.*

The Heat of the Blood of Animals, is caused by the volatile Acid of the Air mixing with it in the Lungs by means of Respiration; and is greater or lesser in proportion to the Quantity of this enlivening Spirit received into the Blood in a given

given Time. And therefore, the Heat of the Blood is much greater in Birds than in Fiſh, as the former in a given Time receive much more of this enlivening Spirit into their Blood by Reſpiration than the latter.

*Obſ.* 6. The Proportion of the Weight of the Heart to the Weight of the Body, is greater in round Fiſh than in flat Fiſh. The mean of this Proportion in round Fiſh and flat Fiſh was $\frac{1}{1100}$ and $\frac{1}{2367}$ in Tables 3, 4. This Difference in the Proportion of the Weight of the Heart to the Weight of the Body in round Fiſh and flat Fiſh, may be owing to a Difference in their Reſpiration and Exerciſe. For round Fiſh often riſe to the Surface of the Water to take in Air, a Thing rarely obſerved of flat Fiſh, which ſtay for the moſt part at the bottom of the Water.

*Obſ.* 7. The Proportion of the Weight of the Liver to the Weight of the Heart is leſs at a Medium in wild Birds than in tame Birds, and in round Fiſh than in flat Fiſh. It is 2.32 and 5.96 in wild and tame

tame Birds; and 24.3 and 29.1, in round and flat Fish. Hence we learn, that those Things which increase or lessen the Proportion of the Weight of the Heart to the Weight of the Body, do at the same time lessen or increase the Proportion of the Weight of the Liver to the Weight of the Heart. And consequently, when an Animal grows fat from much Food, much Sleep, and little Exercise, its Heart lessens and its Liver increases; and on the contrary, when an Animal grows lean from little Food, little Sleep, and much Exercise, its Heart increases and its Liver lessens. There is but one Weight of the Heart of a grown Body, under which Weight the Body enjoys the best and most uninterrupted Health, and that Weight is such as enables the Heart to supply the several Parts of the Body with just Quantities of Blood, such as can preserve the due Magnitudes of the Parts, and thereby hinder them from disturbing the Offices of one another. When the Weight of the Heart is too little for the Weight of the Body, the Liver enlarges beyond its just Magnitude;

Magnitude, and presses too much on the contiguous Parts, particularly on the Stomach, Intestines and Diaphragm, and by that Pressure lessens the Capacities of the Stomach, Intestines and Thorax, whence the Appetite grows less, the peristaltick Motion less, and Respiration more difficult and uneasy.

*Obs.* 8. The Weight of the Liver in proportion to the Quantity of Blood, is less at a Medium in wild Birds than in tame, and in round Fish than in flat Fish. For the Weight of the Heart and Quantity of Blood in all Animals are proportional to each other; and therefore, since by *Obs.* 7. the Weight of the Liver in proportion to the Weight of the Heart is less in wild Birds than in tame Birds, and in round Fish than in flat Fish; the Weight of the Liver in proportion to the Quantity of Blood, will be less in wild Birds and round Fish, than in tame Birds and flat Fish.

Rickety Children have larger Livers, and less Hearts and less Blood, than Children in Health. They have less Hearts and less Blood than Children in Health, from too

full

full and too groſs a Diet, and too little Exerciſe; and they have larger Livers than Children in Health, from the Liver's always increaſing in Weight, when the Weight of the Heart and Quantity of Blood leſſen. In moſt chronical Diſeaſes, the Liver is larger than in Health, as has been found by diſſecting Bodies dying of thoſe Diſtempers; and it is more than probable, that the Weight of the Heart and Quantity of Blood in thoſe Diſtempers, are both leſs than in Health; for moſt chronical Diſeaſes ariſe from too much Food and too little Exerciſe, both of which leſſen the Weight of the Heart and Quantity of Blood, the firſt by cauſing Fatneſs, and the ſecond by occaſioning a Diminution of the Blood's Motion.

Hence when the Liver is grown too large by Intemperance and Inactivity, it may be leſſened and brought to a healthful Magnitude by Temperance and Exerciſe. It may be emptied other ways by Art, but nothing can prevent its filling again, and conſequently ſecure good and conſtant Health, but an exact Diet and Exerciſe.

Purging and Vomiting may lessen the Liver, and reduce it to its just Magnitude; but these Evacuations cannot prevent its increasing again, so long as Persons live too fully and use too little Exercise. This can only be done by lessening the Food and increasing the Exercise. And if sufficient Exercise cannot be used on account of Weakness or some other Cause, frequent Vomits may be substituted in its stead; for frequent Vomits as well as constant Exercise increase the Motion of the Blood. The Effects of Vomits on the Motion of the Blood, appear by the following Experiments. *By observing the Pulse of several Men after taking a Vomit, it has been found, that so soon as a Man begins to grow sick, his Pulse becomes low, quick and irregular, and in the Action of Vomiting is often so low as not to be felt; that in the Intervals between the Vomits, the Pulse is still low and quick, but not near so low and quick as in the Action of Vomiting; and that after the Operation is over, the Pulse rises gradually, and in the Space of half an Hour or an Hour, becomes fuller than it*

*was before the Vomit was taken.* Hence we ſee the Effects of Vomits on the Motion of the Blood, they leſſen that Motion during the whole Time of their Operation, and almoſt quite ſtop it in the very Action of Vomiting; and after the whole Operation is over, they increaſe the Motion of the Blood, ſo as to make it greater than it was before. And from theſe Effects of Vomits on the Motion of the Blood, we diſcover their great Uſefulneſs in the Cure of many Diſeaſes.

For Inſtance, Vomits ſtop Hæmorrhages from ſmall Veſſels. For when a Blood-veſſel is opened, the Blood flows faſter through that Veſſel, and ſlower through all the reſt of the Veſſels, than it did before, by *Prop.* 19 *and* 45 *Anim. Oecon.* And therefore, all that is neceſſary to ſtop a Hæmorrhage from a ſmall veſſel, is to ſtop the Motion of the Blood in that Veſſel, and increaſe its Motion in all the other Veſſels; and both theſe are done by Vomits, as appears by the foregoing Experiments.

The increaſing the Motion of the Blood in all the other Veſſels, will leſſen the Motion

tion in the Veſſel ſupplying the Hæmorrhage, and thereby effectually prevent a Return of the Diſcharge. For the ſame Reaſon, Vomits leſſen immoderate Diſcharges of the Glands, and Ulcers; for they leſſen the Motion of the Blood and Humours in the Parts affected, by increaſing their Motion in all the other Parts. By increaſing the Blood's Motion, repeated Vomits with a proper Diet I have found to be of great Service in diſperſing ſcrophulous Tumours; which may be allowed, when it is conſidered that theſe Tumours are moſt incident to Children and young Bodies, the Motion of whoſe Blood is ſlow; and that they often diſappear of themſelves when Bodies are grown up, and their Blood has acquired a ſtronger Motion. When Obſtructions ariſe from too languid a Motion of the Blood, Vomits are generally of uſe in removing them. And when the Motion of the Blood is too great, and Obſtructions are formed by Cold, in the manner explained in p. 67. Vomits after large Bleeding will be of great Service in removing them. In

ſhort Vomits, repeated according to the Nature and Obſtinacy of the Diſorder, are generally of Service in all Irregularities and Diſproportions of the Motions of the Blood and other Fluids in different Parts of the Body. The Safety as well as Uſefulneſs of frequently repeated Vomits, is evidently ſeen in Perſons at Sea, and in Women with Child. Perſons at Sea who are ſick, and vomit much, are commonly the better for it: And frequent Vomiting in Women with Child, is of Service as it prevents Abortion. As all Muſcles grow ſtronger by Exerciſe, ſo the muſcular Coat of the Stomach grows ſtronger by Vomiting.

*Obſ.* 9. Since fat Animals have larger Livers, and leſs Hearts and leſs Blood, than lean Animals; it is evident, that when a fat Animal grows lean, its Fat and Liver leſſen, and its Heart and Blood increaſe; and on the contrary, that when a lean Animal grows fat, its Fat and Liver increaſe, and its Heart and Blood leſſen. Hence, when a fat Animal grows lean, it firſt

firſt loſes its Fat, and afterwards, when its Fat is waſted, if it ſtill goes on to loſe in Weight, the Loſs then falls on the Heart and Blood; and when a lean Animal grows fat, it firſt gains Fleſh and Blood, and afterwards, when the Fleſh and Blood are increaſed to certain Magnitudes, it then begins to get Fat. So that Animals on the Waſte, firſt loſe their Fat, and afterwards their Fleſh and Blood; and Animals on the Gain, firſt get Fleſh and Blood, and then Fat. Farther, Animals on the Waſte, firſt fall away in their Limbs, and afterwards in their inward Parts; and Animals on the Gain, firſt gain in their inward Parts, and then in their Limbs.

*Obſ.* 10. The Weight of the Body under which an Animal has the greateſt Strength and Activity, which I ſhall call its *athletick Weight*, is that Weight under which, the Weight of the Heart, and the Proportion of the Weight of the Heart to the Weight of the Body, are greateſt. The Strength of an Animal is meaſured by the Strength of its Muſcles, and the Strength of

of its Muſcles is meaſured by the Strength of its Heart; and the Activity of an Animal is meaſured by the Weight of the Heart in proportion to the Weight of the Body; that is, the Strength and Activity of an Animal are meaſured by H and $\frac{H}{W}$. And therefore, the Strength and Activity of an Animal will be greateſt, when H and $\frac{H}{W}$ are greateſt.

If the Weight of the Body of an Animal be greater than its *athletick Weight*, it may be reduced to that Weight, by Evacuations, dry Food and Exerciſe. Theſe leſſen the Weight of the Body by waſting its Fat, and leſſening its Liver; and they increaſe the Weight of the Heart by increaſing the Quantity and Motion of the Blood. And by leſſening W and increaſing H, they will ſoon reduce the Animal to its athletick Weight. Thus a Game Cock in ten Days is reduced to his athletick Weight, and prepared for Fighting. If the Food, which with Evacuations and Exerciſe, reduced the Cock to his athletick

Weight

Weight in ten Days, be continued any longer, the Cock will not have that Strength and Activity which he had before under his athletick Weight; which may be owing to the Loſs of Weight going on after he arrives at his athletick Weight, and then falling on the Heart, Blood and Muſcles, which muſt neceſſarily occaſion a Loſs of Activity and Strength. It is known by Experience, that a Cock cannot ſtand above 24 Hours at his athletick Weight, and that a Cock has changed very much for the worſe in 12 Hours. When a Cock is at the Top of his Condition, that is, when he is at his athletick Weight, his Head is of a glowing red Colour, his Neck thick, and his Thigh thick and firm; the Day after, his Complexion is leſs glowing, his Neck thinner, and his Thigh ſofter; and the third Day his Thigh will be very ſoft and flaccid. Four Game Cocks reduced to their athletick Weights were killed, and found to be very full of Blood, with large Hearts, large Muſcles, and no Fat. The athletick Weight of an Animal is a very dangerous Weight; by p, 67, and *Hipp. Aph.* 3.

*Sect.*

*Sect.* 1. Fevers and Apoplexies are the Disorders, which commonly happen to Animals under or near their athletick Weights. Horſes fed upon dry Food are much more ſubject to Fevers and Apoplexies than Horſes fed upon Graſs; and the former are much nearer their athletick Weights than the latter.

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SINCE finiſhing the above, the following curious and uſeful Experiment, made on a Cow within eight or ten Days of dropping her Calf, was communicated by a Friend.

| | Grains. |
|---|---|
| Cow alive | 6461376 |
| Lungs | 42486 |
| Liver | 77964 |
| Heart | 24528 |

Diameter of the Aorta = 1.9 Inch.

| | |
|---|---|
| Bag with Calf and Liquor | 735840 |
| Calf | 427488 |
| Lungs | 10950 |
| Liver | 9965 |
| Heart | 2628 |

Diameter of the Aorta = .8 Inch.

F I N I S.